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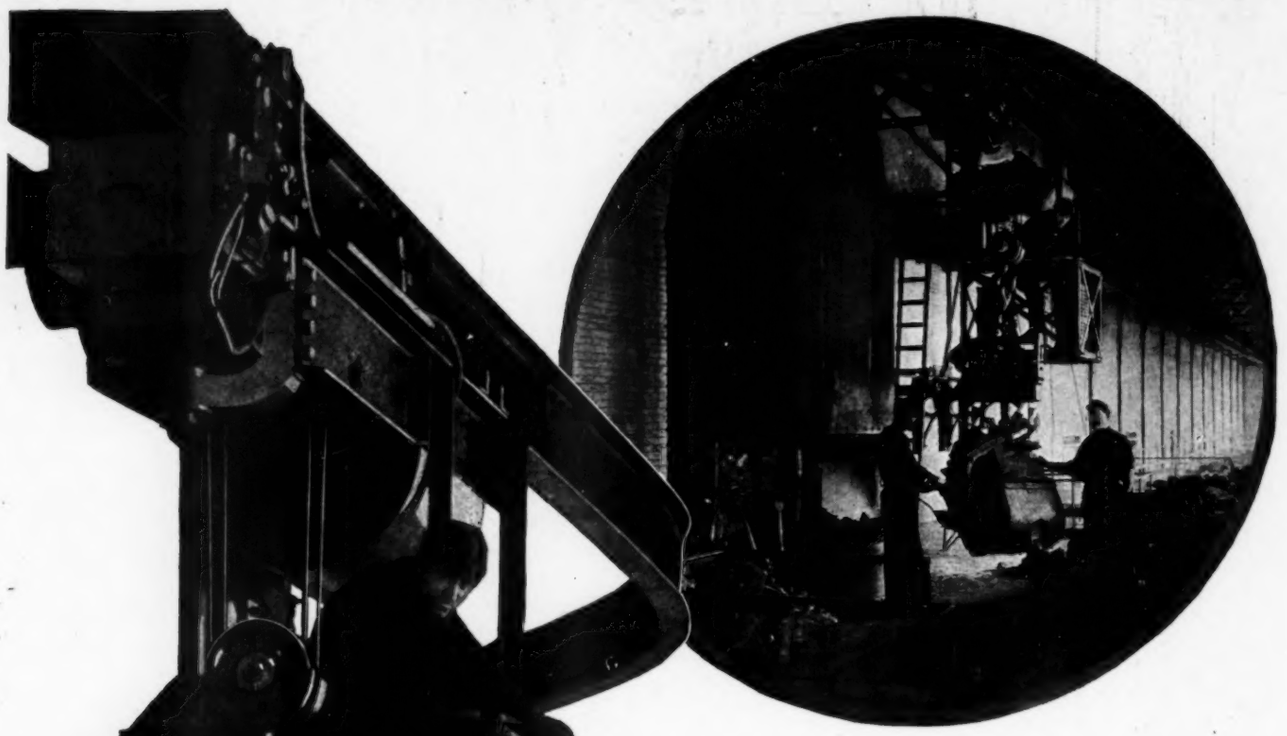

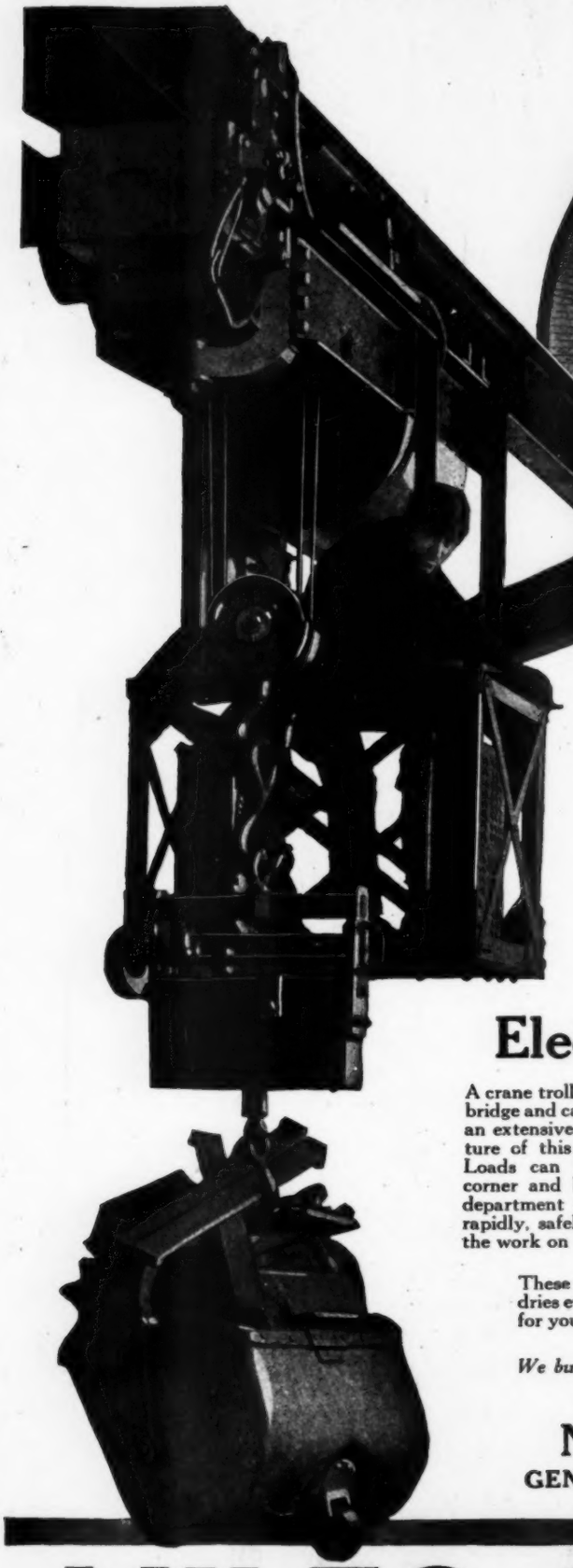

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December 18, 1919 American Machinist Vol. 51, No. 23

The Welding and Cutting Plant at Balboa

BY COMMANDER R. D. GATEWOOD, U. S. N.

No new shop method has grown so rapidly or has been used as extensively as that of welding or cutting by oxy-acetylene or the electric arc. The plant at Balboa is of special interest and facilitates ship repairs of many kinds, some of which are shown herewith.

AMONG the other splendid facilities for effecting prompt and efficient repairs to ships to be found in the Government's shops at Balboa, Panama Canal, are those for oxy-acetylene and electric welding and cutting. The saving of time is the great element at the Canal. Practically all ships using it are carrying heavy loads of valuable cargo when they arrive and the demurrage charges mount up very quickly in these days when the high cost of shipping is such a factor in the world's commerce. No process of recent years has reduced the time for many ship repairs as much as has that of acetylene or electric welding and cutting, and the Governor of the Canal in his efforts to provide all possible facilities for expediting effective repairs to ships has installed one of the most complete and efficient plants of this kind to be found anywhere in the world.

Readers of the *American Machinist* have read with great interest and profit the very interesting articles of Ethan Viall, describing the process, and the latest practices in connection therewith. It may therefore be of interest to them, as well as to shipping men in general, owners and insurance men, to know something more of this plant at Balboa than is generally known.

Plant Description

An exterior view of the plant is shown in the headpiece while Fig. 1 shows one end of the interior. At the left are the containers for acetylene gas and at the right are the racks and apparatus for charging the cylinders with this gas. The product of this shop is not only used for the cutting and welding torches but also for charging the special cylinders used for supplying the navigational lights all along the Canal and along both coasts of the Republics of Panama, Nicaragua and Costa Rica. It also charges tanks for all automobiles, trucks and motor cycles in the Canal Zone and neighboring country. About one million cubic feet was manufactured during the year ended June 30, 1919, the plant's capacity being 400 cu.ft. per hour.

The oxy-hydrogen generating and compressing plant consists of one 50-hp. motor generator set, one 30-hp. set, two 25-hp. sets, which are portable and can also be used for lighting ships and running fans and ventilation blowers on vessels under repair. There are also 60 electrolytic cells together with all the other usual accessories such as gasometers, retorts, scrubbers, distillers, etc.

Facilities are available for manufacturing by chemical process from potassium chlorate and manganese dioxide in case of any failure of electric current, but the usual method is the regular electrolytic one using caustic soda in the water. With electric energy furnished the plant at the low price of seven-tenths of a cent per kilowatt-hour, oxygen is manufactured cheaper than that purchased by any plant in the United States. The plant now has a capacity of over 5000 cu.ft. per day and there was manufactured during the year ending June 30, 1919, about 1,500,000 cubic feet.

Hospitals and Chemical Laboratories Supplied

In addition to that used by the torches, oxygen is furnished to the chemical laboratories and hospitals of the Isthmus and also shipped to small plants along the Pacific Coast. The hydrogen, of which there is about 10,000 cu.ft. per day, is to be compressed with an electric compressor and furnished to the Navy for use in its dirigibles.

It is hard to imagine other similar shops that serve such a varied and large number of purposes. The

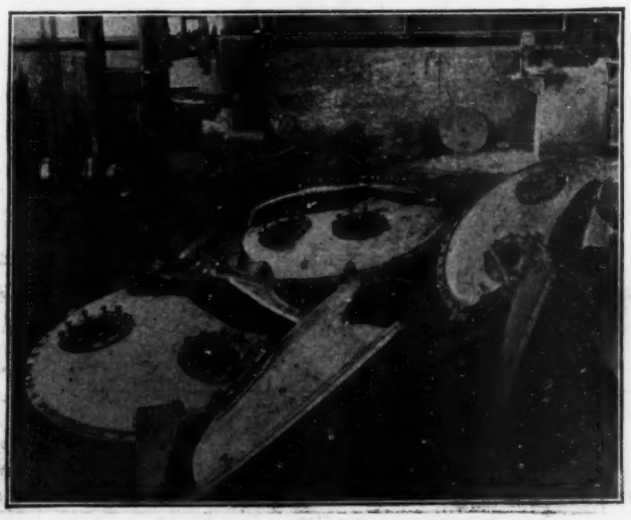


FIG. 2. CONDENSER HEADS TO BE WELDED

amount of time saved by such a plant located so far away from ordinary repair facilities is enormous. In the dry dock alone, for example, thousands of dollars are saved annually to ship owners or insurance companies by the speed with which damaged portions of the hulls can be cut away. *There has not been a single rivet cut out by hand or by air in the Balboa dry dock for over three years.*

The torch is used entirely, even on such light work as torpedo-boat hulls, and results have been extremely satisfactory. The operators are practically all highly skilled men and take a pride in being able to save broken castings that would otherwise involve patterns, castings and expensive machining, and consequent loss of time.

Perhaps the best large job the shop has yet done is that in connection with salvaging the broken parts of the main machinery and auxiliaries on five ex-German ships that had been badly damaged by their crews. Almost every conceivable part of the ships were saved by either oxy-hydrogen or electric welding. This included pumps, valves, jacking engines, blower engines, steering-gear parts, anchor-engine parts, airport frames, etc. Fig. 2 shows the large condenser heads that were successfully patched after preheating, and Fig. 3 shows

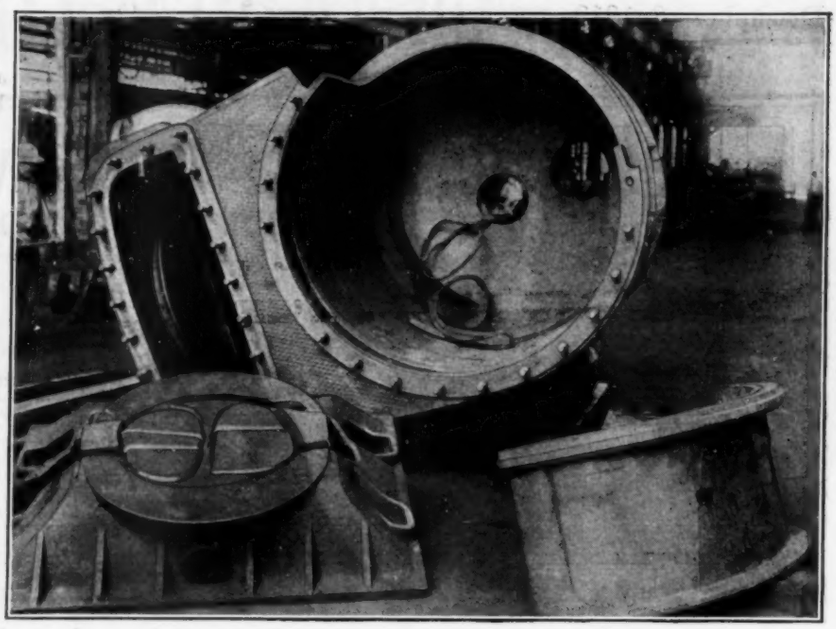


FIG. 3. PATCHING A GERMAN CYLINDER

FIG. 1. A PORTION OF THE INTERIOR

the large slide valve of a low-pressure cylinder with pieces in place and grooved ready for welding. The cylinder patch in the foreground at the right was forged from boiler plate (note the neat job of a swell at top for the counter-bore), with flanges electric welded. This was a highly successful repair effected without overloading the pattern shop, already too busy making patterns for cylinders and parts damaged beyond repair.

The Isthmus is also well provided with electric welding apparatus, there being a portable three-man machine at both the Atlantic and Pacific ends, of the well-known C. and C. Electric and Manufacturing Co. type. Electric welding is particularly economical on the Isthmus due to the low cost of current. When large jobs arise, both machines can be readily transported alongside the ship, and not even in New York Harbor can boiler repairs by this process be completed as effectively and expeditiously.

A Cabinet of Spare Parts

By Peter F. O'Shea

What would you give to be able to repair a broken-down machine and start it up again in 15 min.—no waits, no staring helplessly at a machine day after day because it was idle while parts were being made?

Machines do not stand idle in the tap-fluting department of the Greenfield Tap and Die Corp. The reason is that the foreman of this department believes in preparedness. In the middle of his room stands a locked cabinet, and if some part of one of his machines breaks, he goes over to the cabinet, unlocks it, and picks out a duplicate of the broken part, ready made in advance. The rest is a matter of only a few minutes spent in replacing the part in the machine; then the machine is started and work goes on as before.

Nobody goes home for the rest of the day or is laid off until a repair part comes from a distant shop or from an over-rushed maintenance department. Even the product card at the end of the day may not show the pause, for the workman usually catches up to his regular output.

How many parts must the foreman have in his cabinet, and of what kind? This foreman began learning his requirements and building up his stock a long time ago. When a given part of any machine broke and caused delay, the foreman concluded that the same part was liable to break again. But he determined that the second time it wouldn't cause any delay. So no sooner was he through installing the first repair part than he ordered a duplicate of it immediately, which he quietly locked away in his private cupboard.

But of course, next time the lightning struck in another spot. A part broke very different from the one before. As soon as that machine was started up again, he laid in a duplicate of that part also. Gradually, he found out the spots all over his department where the lightning was apt to strike.

Weak Parts as Safety Valves

Certain parts of machines—arbors, gears, etc.—are inevitably weak on account of the small space they must get into, and the fact that all the strain of driving passes through them. Again, certain parts are purposely designed weaker than the rest of the machine, so that if anything breaks under a sudden overpowering strain it will be a five-dollar part, instead of a part which will cost a hundred dollars and cause the dismantling of the whole machine to replace. The foreman has learned by experience which parts these are on each machine in his department, and these are the parts he has on hand.

Of some parts he has more—two or three—according to the frequency with which experience has shown him they are liable to break and the number of machines of that style in the room. It is sometimes almost as cheap to order two parts as it is one, for the cost of making, due to the cost of setting up machines, is not very much greater

THE SPARE-PARTS CABINET

When the foreman's reserve supply grew too various for him to keep it all in his cupboard, he built a cabinet for the purpose.

This preparedness cabinet is divided into four sections, an upper and lower right-hand and left-hand portion, each having separate doors and separate lock.

The lower sections are for milling cutters and collars.

The left-hand lower section is for cutters and collars in current use. For every cutter there is a collar and they are kept on pegs inserted in small boards, with the cutter number painted on the end. The cutters are all kept nicely sharpened. Those with broken teeth are thrown away. Not very many of each form of cutter are kept in the left-hand section.

A reserve supply of cutters is kept in the right-hand lower section. This serves as a stock, from which cutters are transferred whenever necessary to the left-hand section for current use. The foreman marks down these transfers from stock to use, so that he always knows how many he has in stock. If the reserve supply gets down dangerously low so that a big job might suddenly use them all up, he orders some more. He has established what amounts to a maximum and minimum stock list.

The top sections have five shelves. Miscellaneous large articles are stored loose on the top shelf. The four other shelves are filled with loose drawers of

standard or half-standard size. A ticket on the front of each tells the contents. If two or more parts fit or belong together, they are in the same drawer. The foreman at the moment the photograph was taken was getting out an arbor and a cutter. All he had to do was to reach to the one box containing the arbor and nut, then to the corresponding cutter block below, and he had all he wanted to make a change.

The following parts and accessories are among those which this foreman has learned to keep on hand:

Top Left-Hand Section
Gears in stock for changing flutes
Shifter dogs
Wrenches
Arbors and nuts
File and handle
Screws
Miscellaneous
Oil cups
Ball bearings
Spliner and stops
T-bolts
Index bolts
Centers for holding taps for 10-spindle machine
Centers for holding taps for 5-spindle machine
Centers for holding taps for 4-spindle machine
Male and female centers.

Lower Left-Hand Section
Collars and Cutters In Use. Small amounts of each.

Top Right-Hand Section
New gears to replace those worn out
New Worm gears to replace those worn out
Worm gears
Index plates
New spindles
Ball-bearing racers and collars
Chuck jaw and screw
Knuckles
Belt tool
Pipe wrench.

Lower Ring-Hand Section
Cutters in reserve stock. Large amounts of each.

This cabinet, and the preparedness for which it stood, built up by years of experience in the tap-fluting department, was found so valuable as a money saver that it was recommended to all the other departments.

There are probably many similar ways in which the preparedness idea could be put into practice in most shops. It would save money to everybody concerned—the company on overhead expense above idle machines, the foreman on production, the workman on time work.

Rules of Etiquette To Be Observed in the Machine Shop

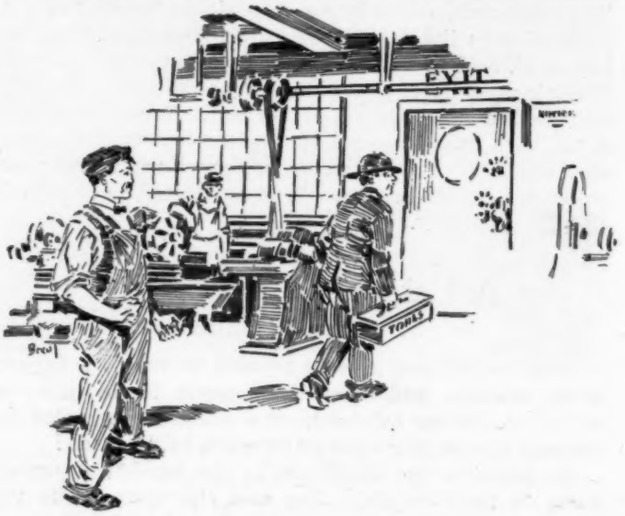
BY JACK HOMEWOOD

When asking for a raise: This is a natural art with some people; with others, an occasion for dread. The time when this feeling of wanting more money is ripe with the latter class, is right after they have done a job that gives them a swelled head. The night before the boss is approached, the seeker of higher wages should procure a pad and pencil and outline what he wants to say. The general line of argument is as follows: "Bill Smith gets more, why shouldn't I?" "Other shops are paying more;" "Been with you for a good many years;" and principally this one, "Big family to feed, high cost of living."

Don't take it as a business proposition and handle it in a business way. Don't ask him point blank if he doesn't think you are entitled to more; that you yourself think so and, because of principle, you are taking the matter up with him before making other arrangements. He doesn't like individuality.

Procedure to be followed after you meet with refusal: As soon as you get home that evening (some do not wait for evening; they get suddenly sick and go home), search the want ads for a job. If you find anything that looks like a life saver, jot down the name and address. Tell your wife you are not well as you leave extra early next morning. Hide your lunch pail somewhere and beat it to the new job. At the new shop you will be informed as follows: "We will pay you so much (an amount five cents less an hour than you have been receiving), if you prove to be as you claim; if not, "out you go, understand?" "Why certainly," you reply, and beat it back to the old shop as fast as you can, making sure as you approach that you are coming from the direction of home. Now perspiring, take out handkerchief and wipe brow as you approach boss with a yarn such as "Wife very sick; sorry I had to lose a little time."

If you get the raise you seek: Run to the first fellow you happen to lay your eyes on and break the news. This will start a run on the bank. Discard



your old hats immediately. Make sure that you don't turn out the amount of work that you did before. Make certain that everybody in the shop knows of your raise, and if it is a quarter make them believe that it is 75 cents at least. Besides making things interesting for the boss this line of conduct will inspire the proper feeling of envy among your associates, and make them treat you respectfully. Don't be appreciative and endeavor to earn your new wage, as the boss may get sore at you.

If you land the new job with advantages: Rush to the old shop and bolt in like a cyclone, pack your tool box and yell out to one of your old mates, "I ain't gonna stick in this hole all my life." Swiftly pass to boss (whom by now you fiercely hate), demand your time and pass out. Don't belittle yourself to give the man notice, as he may be offended at you, and on some future day you may require his good will when you are up against it for a job.

If the new job proves to be a "lemon": Get sick or rig up some kind of an excuse to get off. Try to get a job somewhere else. This may develop in failure for you. Do not worry, because you have the old home job to fall back on. To this you proceed with your ears leaning way back and "your tail between your legs." Approach boss with hat down over your eyes, so that none of the boys will recognize you. Tell him you will be in to work again in the morning; he will be so scared he will say "All right, I'll give you ten cents more than you were getting before; glad you came back as we were just going to close down the shop from helplessness."

Don't think the man whom you so unjustly treated will hold any hard feelings toward you, as the general run of foremen are church goers and believe "that if he smite thee on one cheek, turn the other one toward him." It is strange how a man can kick and abuse a foreman; somehow you can't abuse them enough; they seem to thrive on it.

The Manufacture of Incandescent Lamps—

By C. W. STARKER

In this article and the one to follow it is proposed to give a description of the processes employed in the manufacture of the modern types of incandescent lamps and to explain briefly the physical and chemical facts which form the basis for the manufacturing processes. The history of the development of the incandescent lamp will be touched upon only so far as necessary to an understanding of the processes.

THE fundamental idea that light might be produced by the electric current appeared almost simultaneously with the first discoveries in electricity by Volta and his contemporaries around the year 1800. Sir Humphrey Davy exhibited in 1808 a light caused by passing an electric current through charcoal and also an arc 4 in. long in the air and 7 in. in a vacuum. This demonstration, although of no directly practical value, subsequently led to the realization that the heat which caused incandescence was due to resistance and not primarily to combustion. It was shown that an electric current passing through a wire will heat the wire due to its electrical resistance, and it was demonstrated as far back as 1841 that this heating might be carried to the point of incandescence. These early experimental lamps, Fig. 1, used small spirals of platinum or iridium wire and burned in the open. The next step came with operating the lamp in a vacuum so as to reduce the rate of evaporation of the wire and to increase thereby the life of the lamp. The vacuum also permitted operating the lamp at a higher temperature, and this in turn increased its light output materially.

The invention of the dynamo about 1870 gave a stimulus to incandescent lighting by providing a better source of energy. Various inventors about that time produced crude low-resistance lamps for burning in series, but to Edison belongs the credit for producing the first commercially practicable lamp. Edison first began his investigation of incandescent lamps in 1877, and during that year and the one following tried strips of carbonized paper, but owing to imperfect vacuum they lasted only a few minutes. Very soon he turned his attention to the high-melting-point metals and then followed his well-known patents on lamps having platinum-iridium wire for filaments and on the covering of such wires with oxides of calcium, magnesium and similar materials.

The Carbon Filament

Considerable difficulty was experienced in making the wire filaments of early lamps, due to the inherent brittleness of the rare metals of high melting point, such as iridium. For this reason inventors gradually reverted to carbon as a more suitable material. Its principal advantages were the greater ease of making a thin filament from it, its lower cost, and finally its still higher melting point compared with the metals, namely, between 3600 deg. C. and 4100 deg. C. as against 2900 deg. C. for tantalum and 3270 deg. C. for tungsten. Experiments were made using vegetable fiber and carbonized paper. Gradually the carbon filament was developed and refined to a high degree and held the field exclusively for almost 20 years.

The original carbon lamps consumed between 4½ and seven watts per candle power and their useful life was about 100 hours. Fig. 2 shows the Edison lamp first used in public lighting in December, 1879. It has a carbonized-paper filament and platinum screw clamps connecting the filament with the leading-in wires. The electric-light plant of the steamer "Columbia," started May 2, 1880, was equipped with lamps

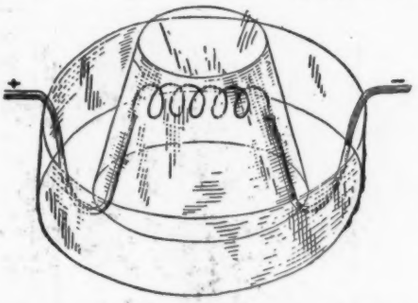


FIG. 1. AN EARLY EXPERIMENTAL LAMP, 1840

like this. Figs. 3 and 4 show lamps using bamboo filaments as first made by the Edison Lamp Co. at Menlo Park in 1880 and 1881. In the former the glass bulb was blown to the shape shown from a 1-in. glass tube. A number of houses were lighted with such lamps as a public exhibition for two nights a week for several weeks. The glass bulb in Fig. 4 made at the glass works at Corning, N. Y., was one of the first lamp bulbs blown directly from the pot. The next improvement was the flat seal and socket shown in Figs. 5 and 6, with platinum or nickel and later copper-plated clamps. In 1884 followed the base shown in Fig. 7, in which the ring of plaster around the neck of the bulb is omitted. Toward the end of this period the filament was attached to the leading-in wires with a carbon paste instead of by the electroplating method.

From about 1888 to 1900 the base was improved by increasing the number of threads; the amount of platinum used for the leading-in wires was reduced and the bulbs were blown in molds instead of in the open-air, so as to make them more uniform in shape. About 1893, with the substitution of the squirted filament for the bamboo filament, longer loops became necessary, as shown in Fig. 8, the ends being supported by an anchor to the stem. A base using porcelain instead

of plaster of paris was introduced in 1900, and the appearance of the lamp from then on was practically the same as that of present carbon lamps.

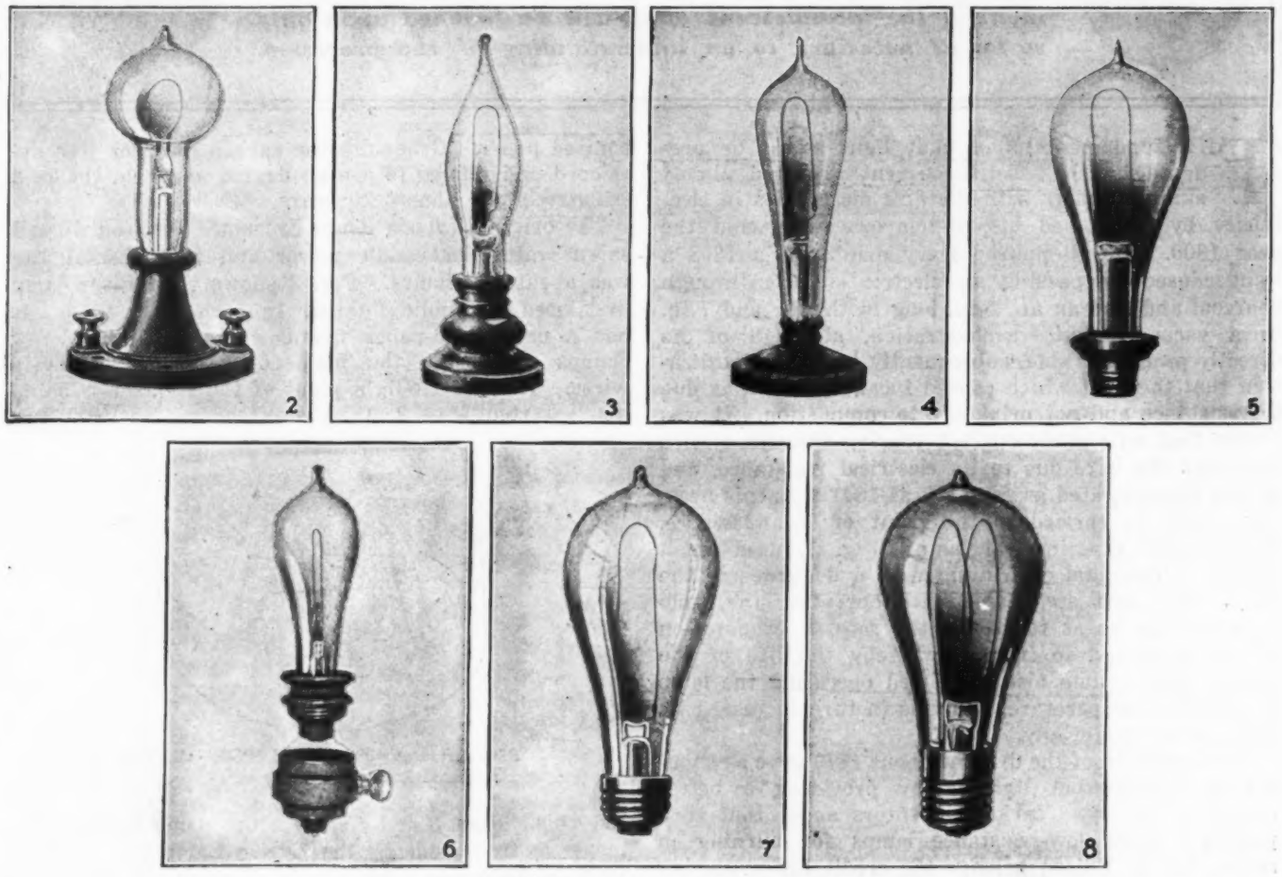
The introduction of the metallized carbon filament, produced by heating the ordinary carbon filament in the electric furnace to a high temperature, reduced the rate of its evaporation and thereby the blackening of the bulb. This increased the useful life of the lamp and permitted an increase of the operating temperature by about 200 deg. C., which meant greater efficiency and greater light output. Efficiencies of 2.5 to 3 watts per candle and a useful life of 400 to 500 hours were reached in this manner.

The process used today in the manufacture of carbon filaments is the so-called squirting process. The material used is a fine grade of cotton, which is dissolved by a strong, hot solution of zinc chloride and hydrochloric acid. At first a jelly-like substance is produced, but finally the cotton is completely absorbed and the resulting liquid, called cellulose, is a heavy syrup. While still hot the solution is filtered to remove impurities, and after cooling it is forced through a platinum die under pressure, Fig 9, emerging as a continuous fine thread, and is passed into a jar of wood alcohol, which solidifies it. The thread is removed, washed in water and wound on drums about 4 ft. in diameter and dried. The dry cellulose thread is wrapped on carbon forms, imbedded in charcoal or graphite and heated to about 3000 deg. C. converting it into carbon. After carbonizing the filaments are treated, or "flashed," in a receptable from which the air has been removed and a carboniferous gas, usually gasoline, substituted. Sufficient current is allowed to flow through the filament to cause it to glow, the heat causing carbon similar to a graphite coating to be deposited on it.

The electrical resistance and mechanical strength of the filament is thereby greatly increased. When the proper resistance is obtained the current is automatically cut off.

A start in a new direction was made when the Nernst lamp appeared, which in principle was based on the discovery that oxides of certain high-melting metals, such as thorium, cerium and zirconium, although nonconductors at normal temperature, have considerable conductivity when heated to about 600 deg. to 700 deg. C. The Nernst lamp used a preheating device in connection with the light-giving filament. These lamps operated at temperatures as high as 1800 deg. and 1900 deg. C. and consumed about 2 watts per candle and had an average useful life of 400 hours.

The early types of incandescent lamps were wire-type lamps, showing that the idea of using metals of high melting point rather than carbon appeared obvious from the start. It is due to the fact that at that time only platinum and iridium were considered, having supposedly the highest melting points, that the carbon filament has so completely held the field for nearly 20 years. After a start had been made research was taken up feverishly by engineers and scientists, so that today there remains hardly a metal that has not been investi-



FIGS. 2 TO 8. EVOLUTION OF INCANDESCENT LAMPS

Fig. 2—One of Edison's first lamps. Figs. 3 and 4—Lamps with bamboo filaments. Figs. 5 and 6—Lamps with flat seals and improved sockets. Fig. 7—Lamp with improved base, 1884. Fig. 8—Lamp with filament supports, 1893

gated for use in incandescent lamps. The three principal representatives in the development of the wire-type lamp are osmium, tatalum and tungsten.

Osmium is a metal of the platinum group, and is in many respects the equal of tungsten. Its disadvantages are its expense and its great tendency to oxidize.

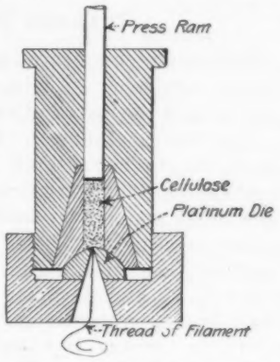


FIG. 9. DIE FOR SQUIRTING FILAMENTS

With the osmium lamp it was possible to form the filament in a continuous wire, while in the first types of tungsten lamps, which followed later, the filament had to be made up in short pieces formed in hairpin shape on account of the brittleness of the tungsten as then made. One of the difficulties of the osmium lamp, as of all metal-filament lamps, was the comparatively high conductivity of the metals, which resulted in an extremely thin and long filament in order to obtain the required resistance. Differing from the carbon lamp, the filament, due to its length, had to be supported, and this was accomplished in the beginning by supports from the sides of the bulbs, Fig. 10, and later by the central glass stem, which was to become the regular practice with all wire-type lamps, Fig. 11.

Attempts were made at covering the wire with a nonconducting oxide with a view to increasing its resistance and thereby permitting shortening of the filament. There occurred, however, the difficulty of a gradual altering of the resistance of the wire in service due the gradual evaporization of the oxide, which in turn resulted in shortening the life of the lamp. The first lamps were for this reason built for low voltages, 25 to 37 volts, and operated in multiple. Later they

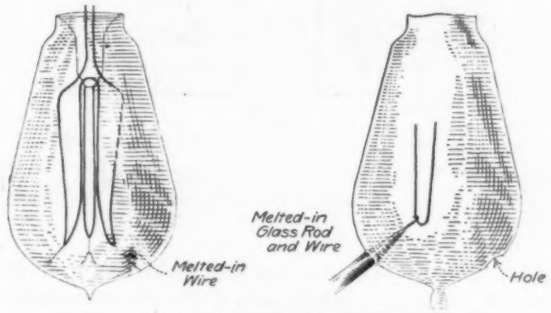


FIG. 10. EARLY METHODS OF SUPPORTING FILAMENTS

were built for voltages up to 110 and in candle powers of 32 to 35 at an efficiency of 1½ watts per candle. Variations in line voltage affected the osmium lamp much less than the carbon type on account of its high temperature coefficient. During the first 200 hours of use a gradual increase in light intensity was observed, due to the surface of the wire becoming smoother, the surface area smaller and the temperature higher. The total life of the lamp was about 2000 hours. With a view to increasing the useful life by preventing black deposits on the inside of the bulb a number of patents were taken out for treating the wire with oxides that would cause white deposits, which obstructed the light somewhat less.

The osmium lamp soon found a competitor in the tantalum lamp, which in turn held the field for a considerable period, even against the early tungsten lamp. In the manufacture of the tantalum lamps small billets of ductile tantalum are obtained from the oxides of tantalum by heating them to a high temperature. This is done by passing a current through them or by heating them in the electric arc. As tantalum has a great affinity for nitrogen and hydrogen, and as even a small content of these gases causes hardness and brittleness of the wire, it was found necessary to perform the heating operation in a vacuum. The melting point of tantalum is approximately 2850 deg. C., and it is readily made into fire wires as small as 0.002 in., having considerable tensile strength.

Since tantalum was made in the form of long wires a continuous filament was used and the methods of supporting the filament referred to before was worked out, as shown in Fig. 12. A serious drawback in the tantalum filament lies in a peculiar change in structure that takes place in the wire while the lamp is in use. During the first 50 hours there is an increase and then a gradual decrease of the light intensity with

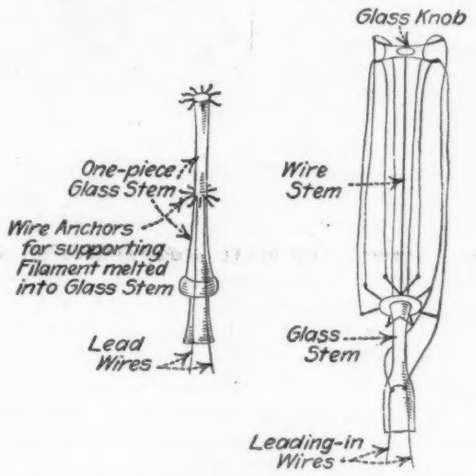


FIG. 11. METHOD OF SUPPORTING OSMIUM AND TANTALUM FILAMENTS

a total life of over 1000 hours. The wire finally becomes rough, assumes a coarse crystalline structure, shortens and thickens, and therefore offers less resistance, which in turn means greater current but less light. The filament, being ductile, the tantalum lamp stood rough usage better than either carbon, osmium or the early tungsten lamps. In fact it was not until the ductilization of tungsten was finally accomplished that the tantalum lamp was superseded.

Tungsten as an ore occurs usually in combination with iron, manganese and calcium, or as the so-called tungstite.

By crystallizing tungsten and treating it with muriatic acid hydrate of tungstic acid is produced. After refining this and obtaining pure tungstic acid it is reduced to tungsten powder by the following process:

The pure tungstic acid is heated in earthen pots for 1½ hours at about 1350 to 1400 deg. C. This leaves a coarse crystalline powder best suited for reducing chemically and resulting in a coarse-grained metal. The hydrogen used in the process is carefully freed from all traces of water and oxygen. Unglazed porcelain tubes are used as containers for the tungstic acid, and they

are provided with a fine channel so that the hydrogen may freely pass over the acid. The tubes are heated rapidly from 1250 to 1300 deg. C., so that a complete reduction of the tungstic acid takes place. After cooling the metal is removed from the tube as a light-gray coarse powder and pressed into bar form. The pressing is done in collapsible steel molds arranged so as to facilitate the removal of the bar, which in this stage is quite brittle.

FIG. 12. A TANTALUM LAMP

The proper pressure is essential, as too low a pressure leaves the bar in powdered form and too high a pressure results in longitudinal cracks. The bars so obtained are rectangular sticks about ½ in. square and 8 in. long, enough to make thousands of feet of filament.

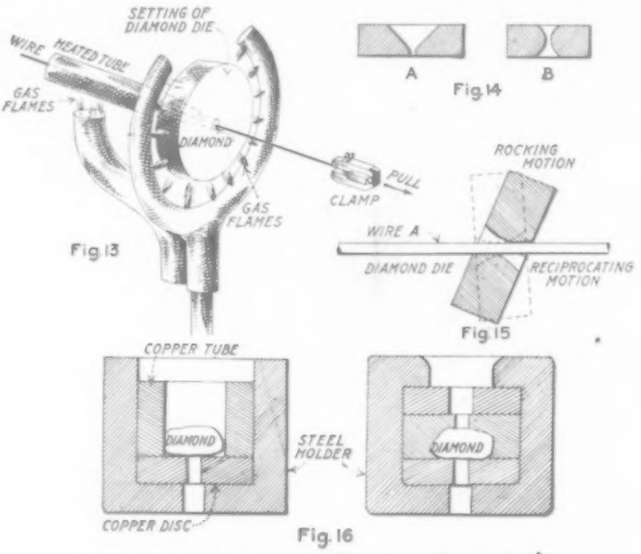
The next operation is preliminary sintering, to increase the mechanical stiffness and strength of the bar. Electric ovens are used for this work and temperatures between 1250 and 1300 deg. C. are employed. The bars are placed on small, flat receptacles of high-melting material and pass through the ovens in an atmosphere of hydrogen. The final sintering is done in a cylindrical water-cooled vessel, the lower end of which is closed gas-tight. In this cylinder there are two water-cooled clamps, one in a fixed position and the other movable to take care of the expansion of the tungsten bar which is clamped between them. These clamps are connected to a 15- to 20-kva. 15-volt transformer. Arrangements are made to circulate hydrogen or a mixture of 20 per cent. hydrogen and 80 per cent. nitrogen through the cylinder. The tungsten bars are heated to nearly their melting temperature. After sintering the tungsten rods are still brittle and hard, so they are again heated in an electric oven, through which hydrogen gas circulates, to about 1300 deg. C. The bar is then put through a swaging machine, heated again, and so on. The swaging is usually continued down to about 0.005 in., when the wire has attained sufficient ductility for drawing.

The following operation of drawing is much quicker than the swaging and is done hot to facilitate the work, although the wire would stand cold drawing. The temperature used ranges between 400 and 600 deg. C., decreasing from the latter figure to the former, as the wire is reduced. It is essential that the drawing be done in very small steps and that the wire be well lubricated with graphite. The principle of the process is illustrated in Fig. 13. The diamond die through which the wire is drawn is mounted in a brass or steel disk and is heated by a semi-circular gas burner. The wire before passing through the die is also heated by passing through a heated tube.

In order to enter the wire into the drawing die it is necessary to point the end. This is done either by immersing the end in nitric or a similar acid or by immersing the end as a cathode in diluted sulphuric acid and passing a current through the wire. After completing the drawing operation the wire passes through a combination apparatus in which it is automatically annealed, the surface cleaned from lubricant and the wire finally wound on a spool.

Diamond Drawing Dies

Making and maintaining diamond dies is one of the difficult problems in lamp manufacture. It is necessary that a series of dies must be available, varying in diameter as follows: 0.000392, 0.000384, etc. The measuring of such small differences is very near the practical limit of the micrometer and microscope. The sizes must usually be selected by trial and experience, particularly as the holes become enlarged, rough or elliptical from use. The size of the diamond used is about 2, 1½ and 1 carats for the larger, medium and small bores, respectively. The hole required for the squirting process is shown in Fig. 14 at *A*, and the hole for drawing is shown at *B*. Making these extremely small holes is a very tedious process, and is done with fine steel needles, using diamond dust mixed with oil at the point of the needle. The final forming



FIGS. 13 TO 16. FILAMENT-DRAWING DIES

Fig. 13—Device for drawing tungsten wire. Fig. 14—Diamond-filament dies: *A* die for squirting, *B* die for drawing. Fig. 15—Method of shaping the hole in a drawing die. Fig. 16—Mounting for diamond dies.

of the hole and of the conical approaches to it is done by special machines, which are designed according to the principle shown in Fig. 15. The wire *A* made of nickel tungsten passes through the hole in the stone and is given a reciprocating motion, polishing thereby the walls of the hole, the wire being covered with diamond dust mixed with oil. The stone mounted in its metal disk is supported on a faceplate and simultaneously with the reciprocating motion of the wire is given such a motion as to produce the desired conical shape of the approaches to the hole.

As for the mounting this is best done as shown in Fig. 16, in which the steel holder is first bored out as shown to the left, after which a copper disk and tube are inserted, also shown at the left, and the diamond placed in position. The copper parts are then pressed around the stone and a metal ring is pressed in on top as shown in the illustration to the right. Some manufacturers are successfully using a

method by which the stone is embedded in the disk by melting silver solder around it.

Before considering the various steps in the manufacture of the lamp itself it may be well to state the general characteristics a filament should have by whatever process it is made. The principal requirements of a good tungsten filament are: (1) The threads should be free from carbon, as this causes blackening of the bulb and also reduces the melting point of the filament and a maximum of 0.01 to 0.02 per cent. of carbon should not be exceeded; (2) they should be strong and ductile after the electric sintering process and have a high metallic luster; (3) in the latter process they should shorten from 18 to 20 per cent., so that no further shortening will occur after the lamp is in service; (4) the threads should not give off any appreciable amount of gases after the lamp is finished as this would deteriorate the vacuum and thereby shorten the life of the lamp.

Using an Underslung Crane in Erection

By A. R. De Kuzelewski

The erection of a 300-hp. oil engine is quite a problem, especially in a building not intended for a power plant and lacking any handling facilities. Fig. 1 shows the plan and elevation of this particular building. In fact it was an old structure used as a drop-forge plant, with a half-dozen wooden columns not shown in the illustrations. These, as will be seen from the general arrangement of the engine room, had to be removed to give space for the engine bases. In order to support the roof of the building two steel I-beams were swung from one crosswall to another, and as shown in the elevation, short pieces on the top of the beams hold the rafters.

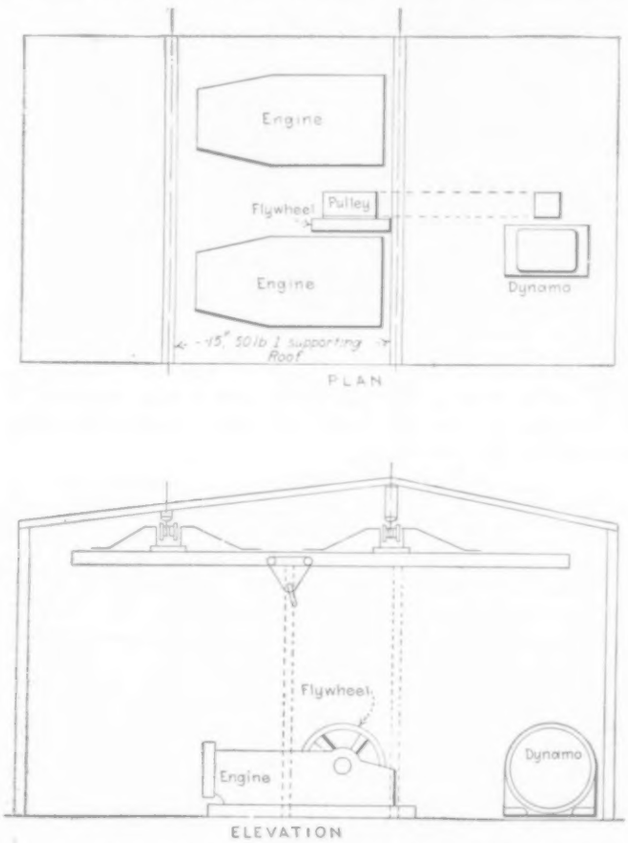


FIG. 1. TWO VIEWS OF ENGINE ROOM

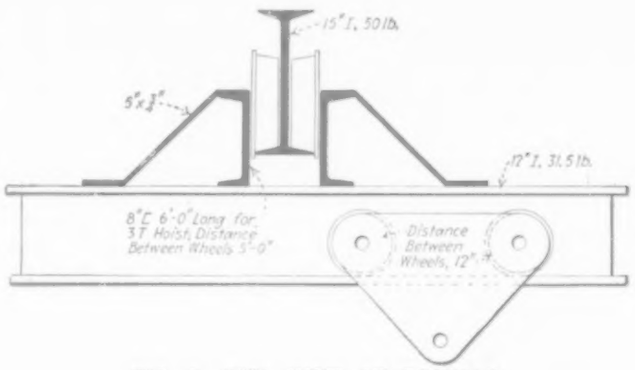


FIG. 2. END VIEW OF RUNWAY

A traveling crane pays for itself in a very short time in most any kind of engine room—and this is especially true in case of an oil engine of large size where such parts as cylinder heads cannot last very long and have to be replaced. In this case the cylinder head weighs about 2000 lb. and the piston about 600 lb.

It was therefore decided to have some kind of a

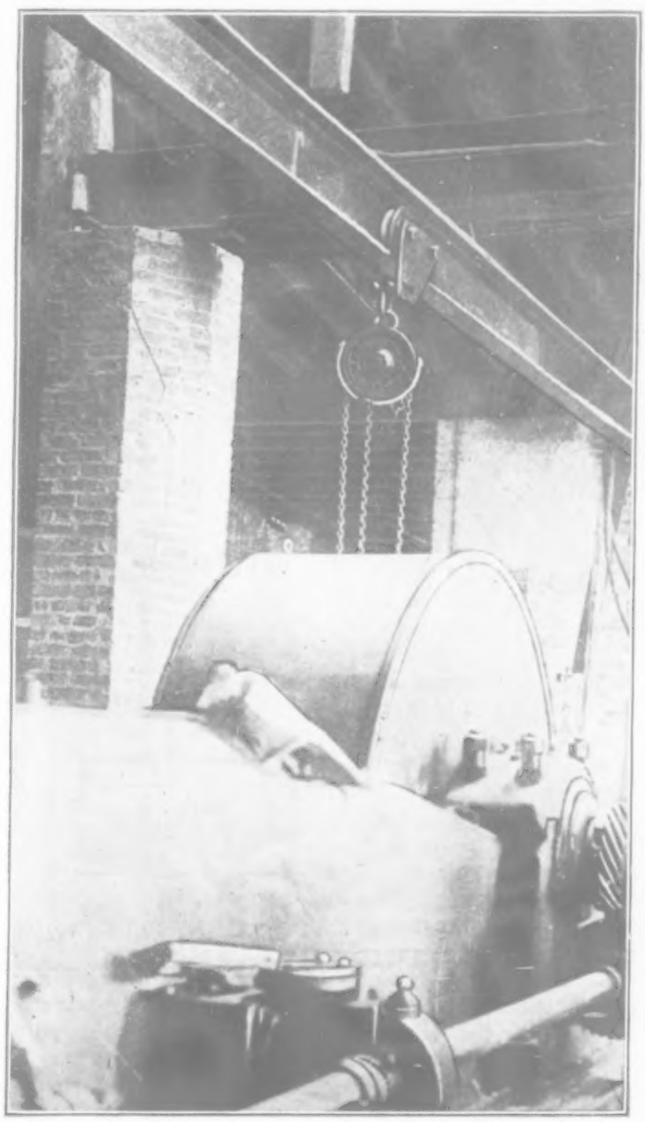


FIG. 3. THE ENGINE IN PLACE

crane installed before moving in the engine, and the two beams supporting the roof were used as runways for a traveling crane of the underslung type. This type, not being used much, proved very practical in this case. The left-hand extension of the crane, about 7 ft. long, helped to install the exhaust, consisting of very heavy pieces of pipe, not shown; the right-hand extension, about 15 ft., with a prop underneath, put the generator on its foundation. The crane on the beams or runways is good for three tons in any place, when supported by 8 x 8-in. timber, as shown by dotted line. It was strong enough to lift the flywheel weighing about six tons. The simplicity of the construction can be seen in Fig. 2. The short distances between the walls did not allow taking a photograph of the entire crane and only one end is shown on Fig. 3.

These sketches and halftones are sufficient to see that the crane paid for itself in the first 10 days of erection.

A 75-Ton Hydraulic Jack Built in a Railway Shop

The Wilson Avenue shops of the Northwestern Elevated System, Chicago, Ill., designed and built the 75-ton hydraulic jack shown in Fig. 1. This jack is the more remarkable because the principal parts from which it was constructed were obtained from some of the old car axles always to be found lying around a railroad shop, as the general outside contour indicates.

The details of the design and operation are illustrated by the sectional sketch in Fig. 2. The two main parts are the outer guide and cylinder jacket *A*, which acts as a container for the lifting fluid, and the ram *B*, which carries all of the operating parts.

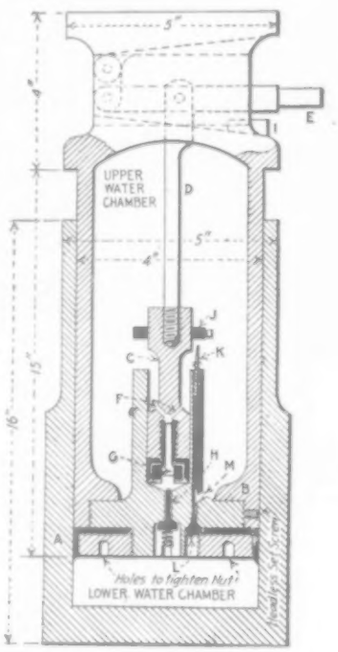


FIG. 2. VERTICAL SECTION OF HYDRAULIC JACK

The lifting force is obtained by means of the fluid contained in the upper chamber which is forced through to the lower chamber by means of the piston *C*. The latter is operated through the plunger rod *D* by means of a hand lever *E*. In the operation the fluid is drawn by the piston to fill the working cylinder through the openings *F* in its walls, from which it passes through the valve *G* into the lower portion of the plunger cylinder. The downward stroke of the working piston forces the fluid in turn through the spring-actuated valve *H* into the lower water chamber, from which point its upward thrust gradually raises the lifting ram of the jack. When it is desired to release the jack so that the ram will return to its closed position, the plug *I* is removed from the slot in which the handle *E* works so that the handle can be lowered until the collar *J* comes in contact with the upper end *K* of the release-valve rod. This rod is then forced down until the valve *L* is unseated, permitting the water to escape and return to the upper cylinder through the passage *M*. Details of the leather disk packing and spring parts can be readily understood from the illustration.

This jack has been actually tested out in the wheel press with over a 100-ton load, which was applied to it in order to get some idea of what it could actually sustain in an emergency.

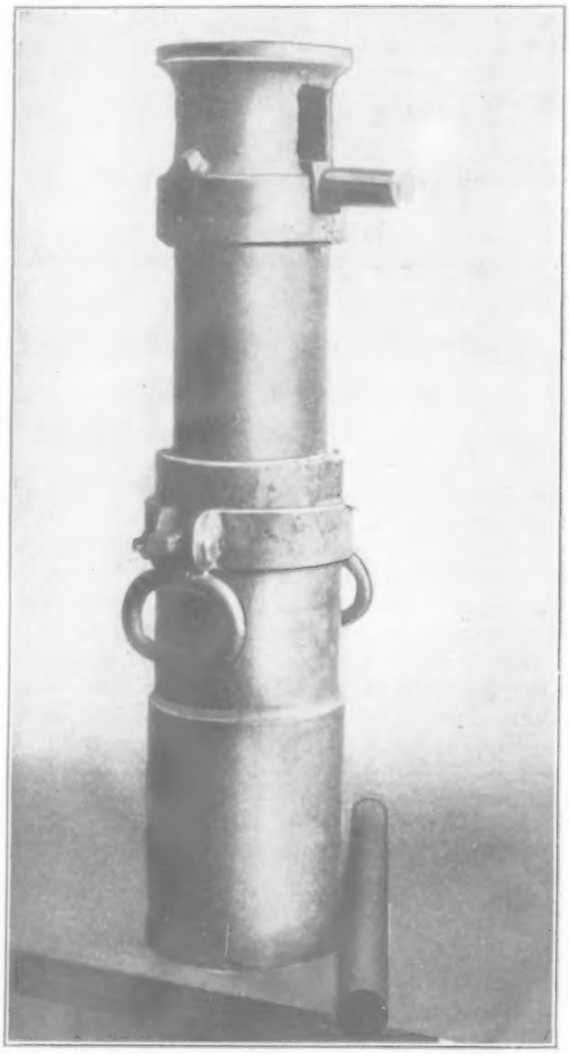
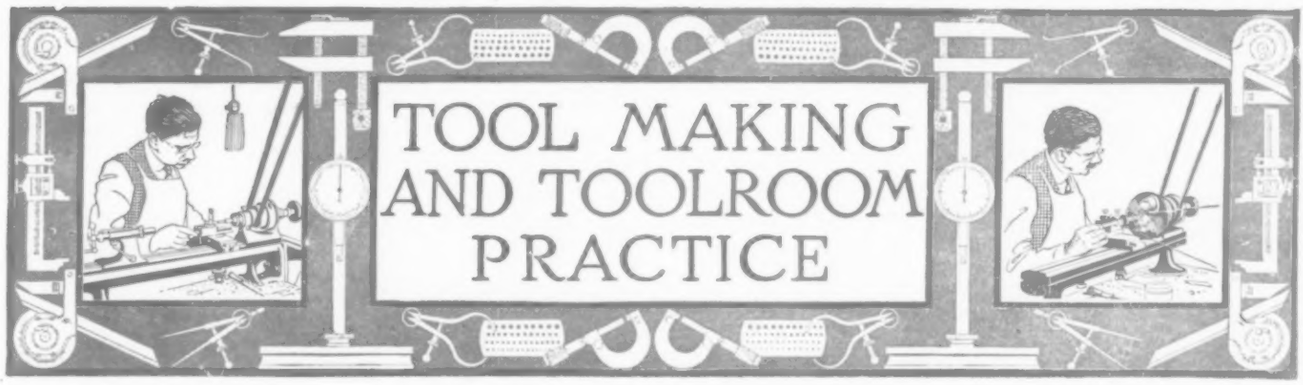


FIG. 1. HYDRAULIC JACK MADE IN THE ELEVATED RAILROAD SHOP

A Question of Etymology

By Alonzo G. Collins

It occurred to me, when reading the article by C. H. Norton, with the above title on page 795: Mr. Norton takes exception to any one calling himself an American, who uses the word "grinder" to describe a grinding machine; but on turning to page 118 of the advertising section I find the hated word used twice in an advertisement of the Norton Grinding Machine Co., which, I believe, is the company he represents. I have not time to verify the statement, but I think that the word "grinder" as describing a grinding machine, is used oftener in the advertising section of the same issue of the *American Machinist*, than is "grinding machine."



Elements of Gage Making—VII*

By C. A. MACREADY

The average machinist associates the soldering iron with the tinsmith and tinker and will hardly appreciate its indispensibility in connection with gage work. When learning its use in this line of work, he will discover that it can cause errors when used to attach gages temporarily to auxiliary pieces used to hold them while being machined. These errors may, however, be avoided.

THE troubles that the machinist using the soldering iron will experience will be: Movement of the work after being soldered to a piece; rusting and distortion of the work due to the heat required to melt the solder. Movement of the work after being placed and soldered accurately in position is caused by the unequal distribution of the solder used to "tack" the work on the seat. That is to say, each portion or "tack" of solder is not the same size, so the stronger pulls against and overcomes the weaker during the cooling period.

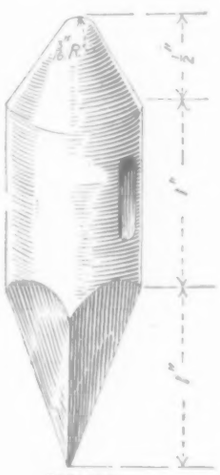


FIG. 102

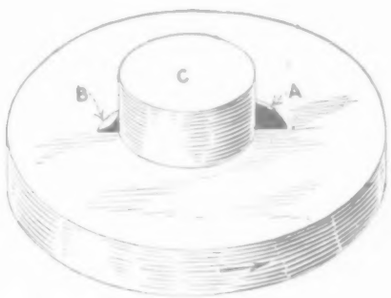


FIG. 103

FIGS. 102 AND 103. THE SOLDERING IRON AND METHOD OF SOLDERING

The portions of solder can be partly equalized by the use of the soldering iron illustrated in Fig. 102, which is the regulation-pointed copper about $\frac{3}{4}$ in. in diameter. One end has a rounded corner about $\frac{3}{16}$ in. in radius. This end is used after the solder has been "tacked" on in spots by using the pointed end. The rounded end forms a fillet of solder the size of which may be increased if necessary by holding the copper at an angle lengthwise. If the copper is at the proper heat the rounded end will form a fillet that is not "lumpy," but the fillet of solder on one side may be longer than that on the other side. The cross-sections of a lump of solder *A* and a fillet of solder *B*, illustrated in Fig. 103, show diagrammatically what causes the unequal pull by the solder when it contracts in cooling. When cooling, the larger solder lump *A* will pull the piece *C* in the direction of the arrow.

Common soldering acid, zinc and muriatic acid, must not be used when "tacking" or soldering gages to be worked. It is practically impossible to destroy the corrosive action of the flux that may get between the gage and the seat. The acid often eats the gage enough to make it impossible to finish it to size with a clean surface. Excess of acid leaves a residue which eats the steel and seat exposed to its action and is therefore productive of other objectionable effects because it eats the steel under the solder and weakens the joint, causing a rotten surface which is liable to let go under stresses that a clean solder connection would carry with ease. In this connection it may be mentioned that a well-soldered joint is remarkably strong.

There are several non-corrosive soldering fluxes which will not eat or rust steel, but most of them are liable to objectionally tarnish a finished surface. A soldering flux composed of chloride of zinc, glycerine and alcohol makes a good non-corrosive flux for this class of work. Alcohol and glycerine in about equal parts are mixed with chloride of zinc. Enough alcohol should be kept in the bottle to make a clear flowing mixture. A clean mucilage bottle with a brush in the cork is a good container.

All hardened parts of gages should be heat-treated or "drawn" until soft solder will melt on them. *This should become a habit* as omitting it is the principal cause of aggravating errors. It is a precaution the gagemaker often neglects and the average machinist knows nothing about.

Hardened steel that has been heat-treated or drawn at a temperature higher than that to which it will

*Prepared for the author's forthcoming book, "Elements of Gage Making."

later be subjected will not excessively distort when subsequently subjected to the same or a lower temperature. There are times when the gagemaker is not able to foresee that soldering must be resorted to. If the part has been finished without being heat-treated or drawn distortion that is liable to spoil the gage will occur when it is soldered. Therefore all gages should be heat-treated, and it must also be remembered that heat-treatment is beneficial as it also helps to season the gage.

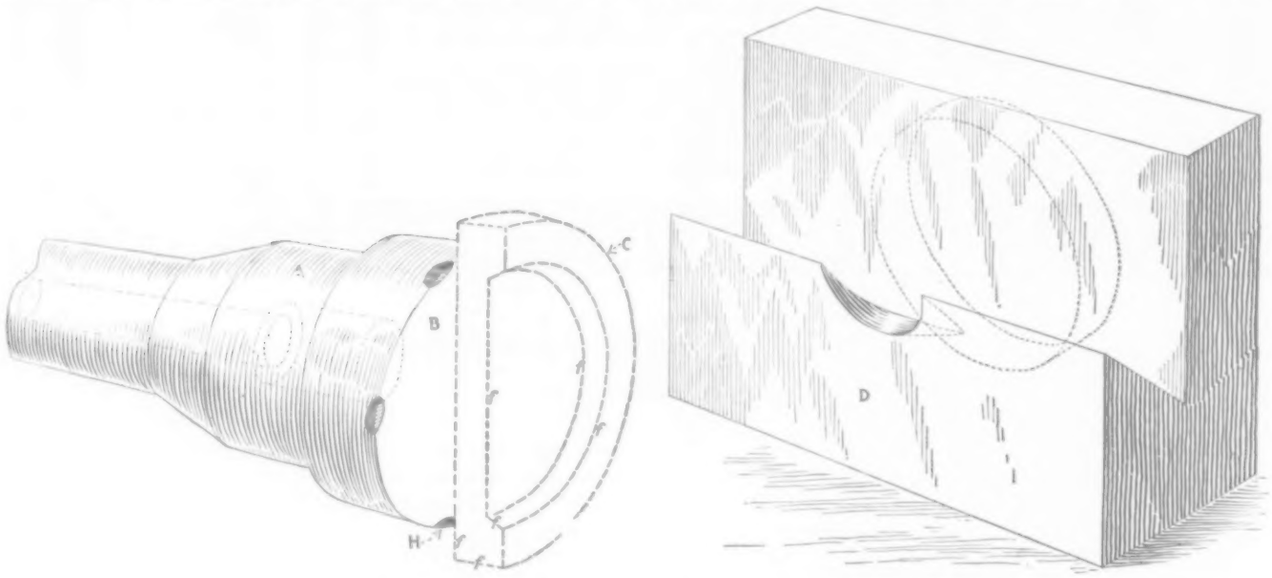


FIG. 104. THE SOLDER CHUCK AND A SEAT FOR THE WORK

Solder Chucks

Solder chucks are used to hold work that must be accurately machined. In Fig. 104 is shown the principle used. The part *A* is made of soft steel the same shape as the ordinary spring chuck, but is not split. The sectional view, Fig. 105, shows the end of the chuck bored to receive the stem of the brass piece *B* which is soldered into *A*, Fig. 104. This brass piece is machined to the shape necessary to control the working surfaces on the gage while using a bench-lathe milling and grinding attachment, one of which is shown in Fig. 106.

The short heavy lines *H* between the brass chuck *B* and the work *C*, in Fig. 104, are four bevels filed or milled opposite each other in the edges of the brass chuck to form pockets to hold the solder. It is sometimes required to finish part of the back of the work at the same setting in which the front is finished. These bevels will retain enough solder to hold the work down to the surface of the brass chuck. In some cases to produce accurate results it is necessary that all surfaces be finished at one setting. The piece *C*, in dotted lines, on the chuck *B*, in Fig. 104 can be finished on all surfaces marked *f*. The seating surface, which is true to start with, will remain so if the chuck *B* is trued before soldering the work to it as shown.

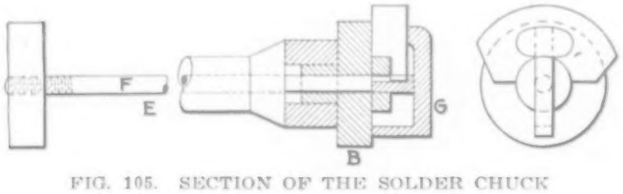


FIG. 105. SECTION OF THE SOLDER CHUCK

The removal of the work from the chuck is accomplished with two hot pieces of brass rod beveled on their ends to a sharp edge. When the solder softens, the tapered ends act as wedges and break the other soldered spots. If a blow is used, it is liable to cause the brass chuck *B* to run out of true. These brass chucks if large are often drilled out to go over the outside of the steel chuck and are soldered thereto instead of being held by a shank as shown in Fig. 104.

The seat shown at *D*, Fig. 104, is one of many that may be required, and is originated very accurately and rapidly by setting the "milling attachment" to the angle required. The different movements and adjustments for parallel and angular surfaces are shown very plainly in Fig. 106. In Fig. 105, the work is held by a long bolt that goes through the hollow spindle of the lathe. A boss is turned on the face of the brass piece *B* to fit the hole, or opening in the work and take the

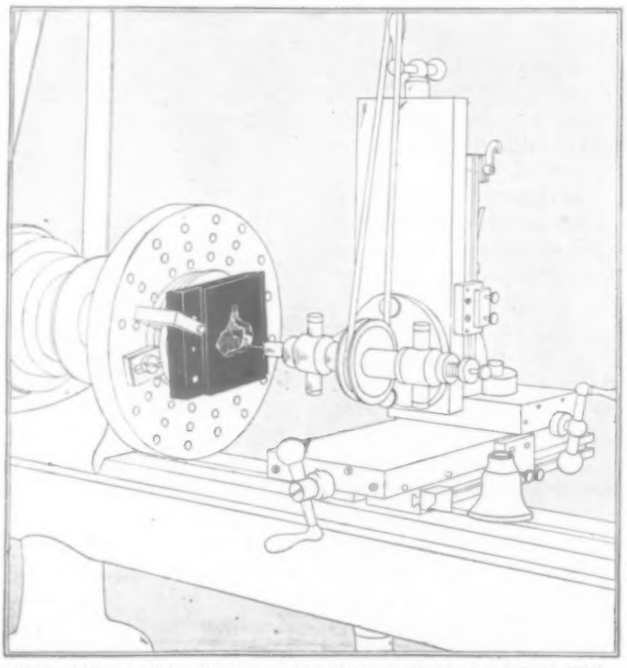


FIG. 106. MILLING AND GRINDING WORK SURFACES

place of an arbor. The clamp *G* or washer or even the end of the bolt is shaped to take a seat on the work as desired.

Another example of the use of solder for attaching work to temporary seats in order to facilitate machining is shown in Fig. 107. Some small gages are difficult to hold in the position required to machine them. The gage *A*, if soldered to the parallel soft-steel piece *B*, can be clamped in any position required to machine it, using the surfaces *BB* for the clamping surfaces. The back edge *C*, is ground parallel with the angular sides of the gage by using the principle described in Figs. 71 and 76, where a cylindrical plug acts as a parallel upon which to bed the gage. The bottom of the seat *B* should be tested after soldering and corrected if found out of true. Generally, there are points on the work from which the surface *D* can be tested. In the diagram *E* the spots show the soldering.

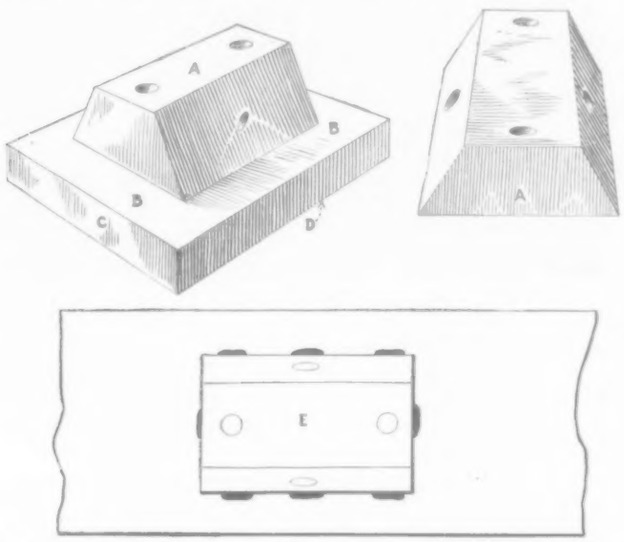


FIG. 107. ANOTHER METHOD OF HOLDING BY SOLDERING

It must be understood that *there is no solder or tinned surface used between the solder chuck and the gages* described in Figs. 104 to 107. As there will be several examples shown of the use these seats are applied to other gages, the same precaution should be taken to guard against displacement of the work due to unbalanced spots of solder along the edge of the work. It will be good practice to allow newly soldered chucks or work to stand over night or as long as possible before finishing the surfaces that are required to be accurate. The surfaces of the brass seats should also be tested if they have stood over night before concluding the machining operations on the gage.

In most shops using solder chucks, there is generally a supply of brass chucks that have been used before on other work. The solder on these has had time to equalize the stresses mentioned and if the required new seats can be machined as wanted, these old chucks are safer to use, especially when the time required to finish the work is more than one day. It has been found good practice in some high-grade shops to give each gage or mold maker several of the steel blanks *A*, Fig. 104. This allows him to solder in a suitable brass piece *B* ahead of time and permit the stresses from the uneven amount of solder around the stem of *B* to equalize. The time required to equalize the solder stresses also depends upon the distance the brass piece *B* extends beyond the steel piece *A*. The ordinary chuck takes about 12 hours. The removal of surplus solder and the separation of soldered pieces similar to *A* on the seat *B*, Fig. 107, is accomplished with safety if *brass* chisels, scrapers and hand tools are used. These should be made the regulation shape. If these brass tools are used to remove the solder from a *soft* steel gage, be sure that the brass is *annealed*.

Making Ball Buttons

For the ball part of these buttons, high-grade commercial steel balls can be used. The 0.25- and 0.50-in. diameters will cover a wide range of work and can be used with different sizes of plugs as wanted. The ball button illustrated in Fig. 21 is adjustable for position and is held to its seat on the work by a screw tapped into the seat of the button. This style of button is used to locate the positions of the axes of roughed-out holes or the point of incidence of their axes with the planes of the sides. They are not attached to the work firmly enough to act as stable points from which to work when grinding the angular sides of a gage as shown in Fig. 77.

Ball buttons that are used to determine the relation of angular sides of a gage to a finished hole are misnamed as they are really ball-ended plugs which fit a finished hole to indicate the location of the axis of the hole. Both styles of buttons are made in the same way up to the plug part.

It was stated in connection with seats for work on solder chucks that tinned surfaces were not used. When making the seats for the balls, "tinned surfaces" must be used, as the surface of the ball in making some angular measurements must be exposed as much as possible. It must also be free from solder in order to obtain a surface from which to measure or indicate for axial truth. The ball and plug are heated to the temperature of melted solder, flux is applied and the ball and the seat for it in the plug are tinned.

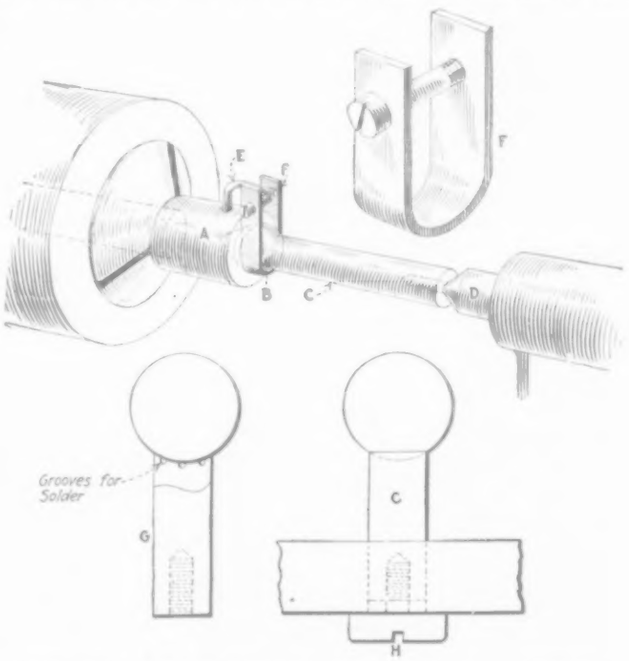


FIG. 108. A BALL BUTTON SOLDERED TO A CHUCK

There should be a minimum amount of solder between the steel surfaces to reduce the objectionable effects of uneven stresses when cooling. But there must be a body of solder strong enough to retain the ball upon

its seat. Space is made for this amount by turning the grooves in the seat in the end of the plug. This seat is formed, as shown at *G* in Fig. 108, to approximately fit the surface of the ball. The edge is also beveled to retain the solder. All seating surfaces on the plugs, that have been discolored by hardening, must be made bright and perfectly clean. The cleaner the surface the firmer the solder joint. Ordinarily, solder will not attach itself firmly to oxidized or greasy surfaces.

When making this style of button care should be taken that the tail spindle of the lathe is in line with the axis of the live spindle. If it is out of line it will cause a revolving motion at the seat in the plug for the ball if the spindle of the lathe is rotated when seating the ball in place while soldering, and will cause a weak joint. If the spindles are out of line the error can be overcome by locking the live spindle and rotating the plug between the fingers when finish soldering, applying pressure with the tail center *D* in the 60-deg. countersunk and tapped hole used for a center.

As there has been enough heat applied to melt soft solder during the operation, it is very liable to displace the brass female cone *A* when it cools. This cone should be cooled and retrued before grinding the plug *C* which is finished the same as an ordinary working plug gage; that is, one that will take a set but retain lubricant as previously described. A piece of sheet metal *F* is used as a "dog." A bent piece of drill rod *E* is used as a driver. This combination should be used, for if the tailstock center is tightened sufficiently to drive the work by means of the friction of the ball in the cone, the tailstock end of the plug will become warm to an objectionable extent. This same driver *E* is also used when lapping the plug to size.

The thread tapped in the end of the plug *C* should be about 40 per inch. It is used for adjusting the height of the ball, using a screw as shown at *H*. Never adjust for height by tapping the ball. Use the head of the screw to tap on, or draw the ball down. When the ball is at the required height the screw is removed.

Novel Crane Doorways

The illustrations show how the Heine Safety Boiler Co., St. Louis, Mo., has solved the problem of getting a traveling crane in and out of the erection building of its plant. Fig. 1 shows the end of the boiler-erecting shop with all of the doors closed. Fig. 2 shows the loaded crane passing out with all of the doors open. Fig. 3 shows the crane at work on the outdoor runway shifting boilers from place to place and with the doors of the building closed.

FIG. 1. CRANE DOORS CLOSED

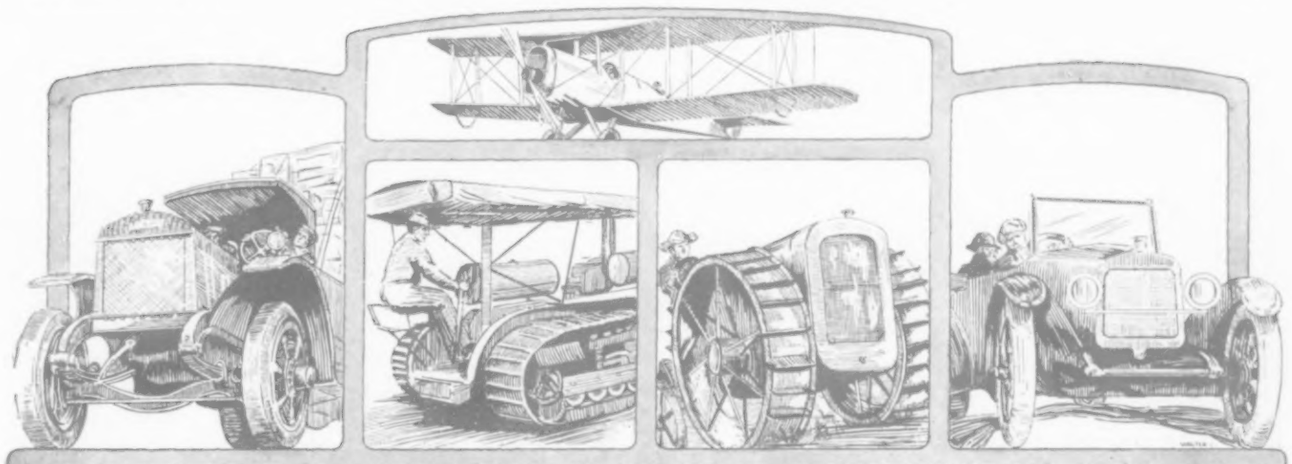
FIG. 2. CRANE DOORS OPEN

The wide upper door, which contains seven windows, as shown in Fig. 1, is 64 ft. wide, weighs 9000 lb. and is lifted by compressed air. Two small swinging doors are visible in Fig. 1 beneath the left-hand girder through which the cage of the crane passes. These doors swing open simultaneously with the lifting of the wide door. The two central swinging doors, shown most clearly in Fig. 1, are each 27 ft. high and 8 ft. 6 in. wide, and are operated from the inside by means of a hand crank. The dimensions and design are such that the doors swing open with very little exertion on the part of the operator.

The crane, Figs. 2 and 3, is of the 30-ton electric type, of 60-ft. span. Two cranes are operated on the same runway, the second being a light 5-ton crane equipped with a motor generator for a lifting magnet used in connection with the smaller work.

As will be noted, the words "Safety First" are plainly painted in large letters along the full length of the large crane. The crane girders are painted white, to contrast as sharply as possible with the surroundings inside the building. Although the building is amply provided with windows, the metals handled and the interior in general are dark in color; hence the workmen will have no difficulty in seeing the white crane.

FIG. 3. CRANE IN YARD, DOORS CLOSED



AUTOMOTIVE CONSTRUCTION

How Ford Built Liberty Motors

By FRED H. COLVIN
Principal Associate Editor, *American Machinist*

A picture story of some of the interesting fixtures used in assembling Liberty motors at the Ford plant. Many of the assembling operations shown here can be easily adapted to other work.

THE accompanying illustrations give a brief outline of some of the interesting operations performed in the building of Liberty motors at the plant of the Ford Motor Co., Detroit, Mich.

The way in which the cylinders were forged has already been described in a previous article, and Fig. 1 shows the boring out of the flash which the forging of the flange leaves in the cylinder. Fig. 2 shows the way in which they rigged up the electric welding machines to weld the elbows on the cylinders. This was done before the cylinders were finish-bored, and by so doing all cylinder distortion, due to the welding, was cut out in the finish-boring.

FIG. 4. WELDED SEAMS ON HEAD

Fig. 3 shows how the cylinders were held while chipping off the flash from the welding with air hammers. The cylinders are mounted on a large ball vise, which is sufficiently heavy to hold them in any desired position. At the left is the tank in which the welds are tested for leakage by forcing air into the cylinder bore. Some idea of the amount of welding on the head of the cylinder jacket can be seen in Fig. 4.

Figs. 5 and 6 show the

FIG. 1. BORING CYLINDER "FLANGE FLASH"

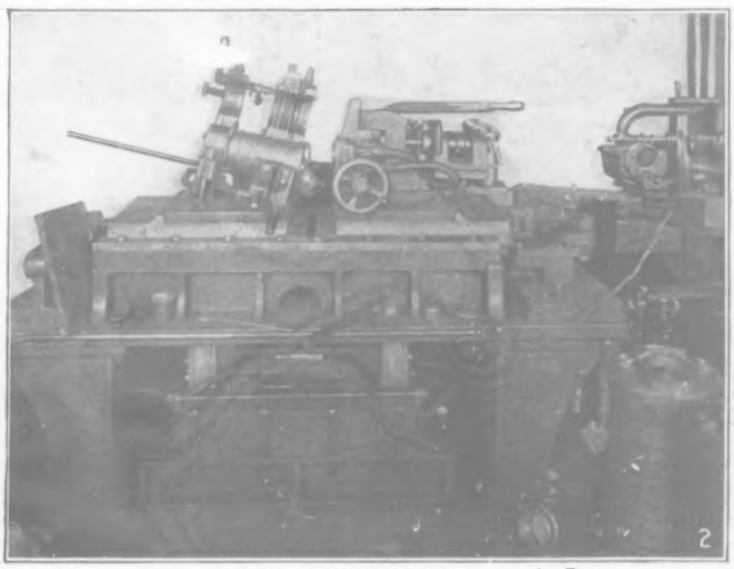


FIG. 2. WELDING VALVE ELBOWS

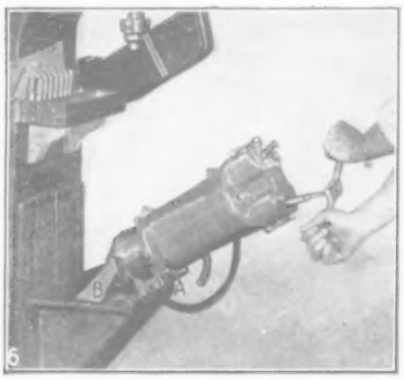
AUTOMOTIVE CONSTRUCTION

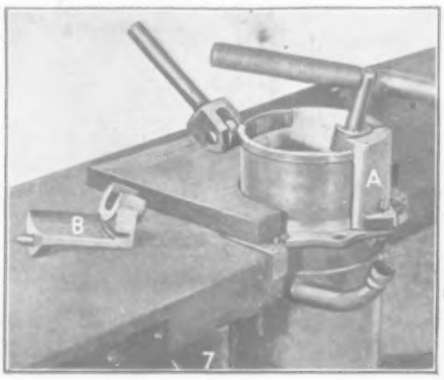
FIG. 3. CHIPPING CYLINDER WELDING

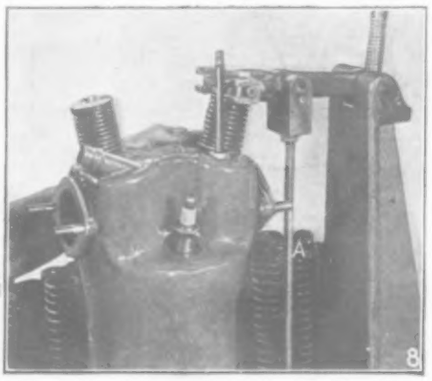
FIG. 5. PRESSING IN VALVE-STEM GUIDES

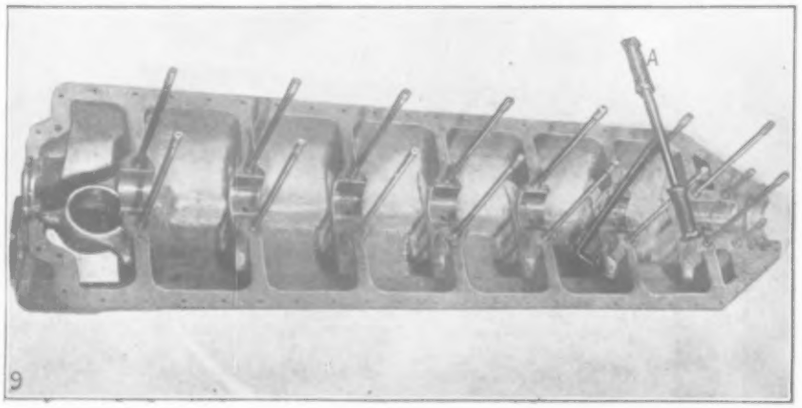
pressing in and reaming of the valve-stem guides, and the use of a very ingenious fixture which holds the cylinder for both operations. It will be noticed that the bolt holes in the flange of the cylinder are located by means of the three dowels shown at *A*. The cylinder is then swung over into the position shown in Fig. 6, the stop *B* holding it so as to be conveniently reamed.

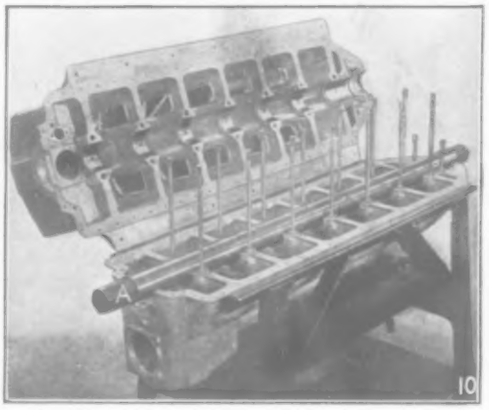
Another convenient reaming fixture is shown in Fig. 7, this being for the final hand-reaming of the valve seats. The piece *A* which is the same as the one shown on the bench at *B*, slips over the edge of the cylinder and the dowel locates it in one of the bolt holes. The C-shaped opening at the upper end guides the shank of the seating tool. A very simple clamp holds the cylinder firmly in position by means of the bolt flange,











FIGS. 6 TO 10. REAMING OPERATIONS AND TESTING

Fig. 6—Hand-Reaming Valve-Stem Guides. Fig. 7—Hand-Reaming Valve Seats. Fig. 8—Putting Retainers on Valve Stems. Fig. 9—Wrench for Crank-Case Studs. Fig. 10—Testing Bearing Alignment.

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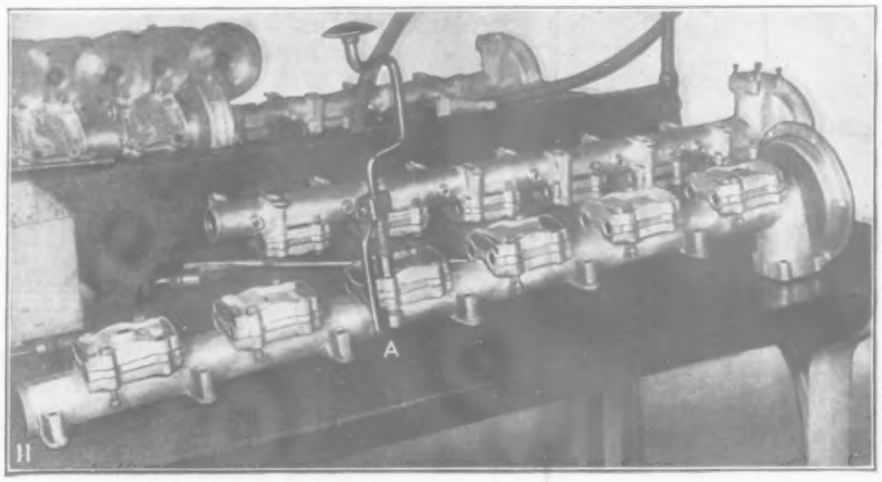
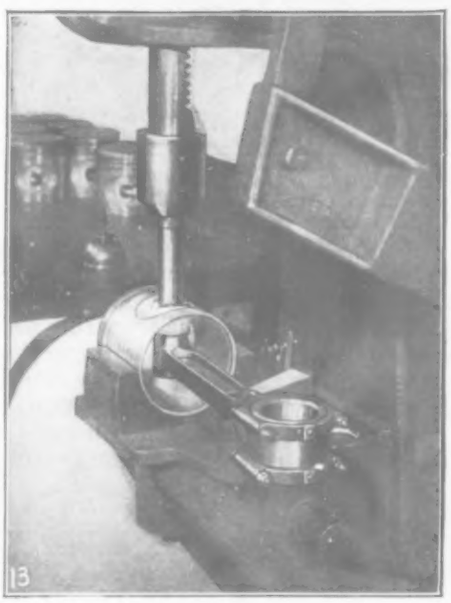
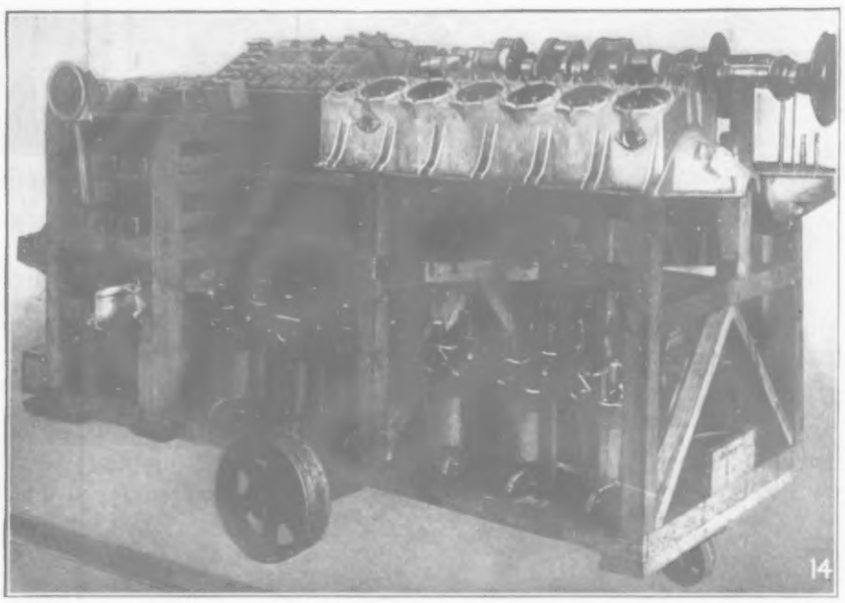
reducing the handling time to a minimum. Fig. 8 shows the apparatus for compressing the valve springs so that the retaining rings can be easily slipped in place around the valve stem. The spring is compressed by means of a foot-operated treadle with rod

the under side of the rocker cover, while the bolt is screwed into it. The arm *A* holds the nut in position and also prevents its turning, while the bolt is screwed in by means of the brace shown. A little study of the shape of this whole camshaft housing will indicate some







FIGS. 11 TO 14. NUT HOLDER, ASSEMBLING AND TRUCK WITH PARTS FOR A COMPLETE MOTOR
Fig. 11—Wrench and Nut Holder. Fig. 12—Putting in Piston Rings. Fig. 13—Forcing in Piston Pins. Fig. 14—Truck with Complete Motor Parts.

A, leaving both hands free and permitting the retaining rings to be quickly placed in position.

The crank case with the studs assembled in position is shown in Fig. 9. This shows at *A* the type of box wrench used for tightening the nut on the under side of the frame ribs. The crankshafts are line-reamed and tested for the bronze shells or bearings which fit in each web. These shells are then tested by means of the test bar *A*, shown in Fig. 10, and should any bearing prove higher than the rest, this shell is removed and its seat scraped to permit it to assume its proper position in the crank case.

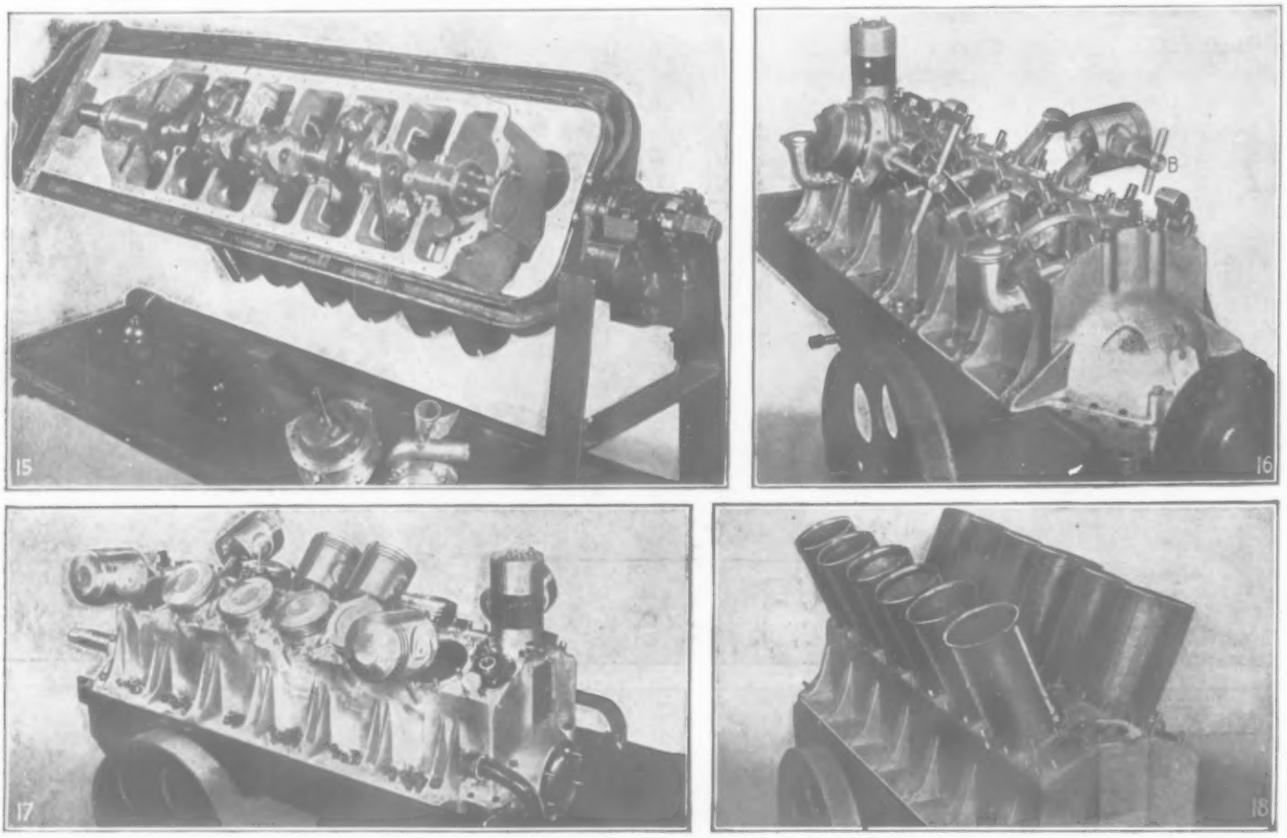
Another ingenious tool is shown at *A*, in Fig. 11. This is a special wrench used for holding the nut on

of the problems involved in its manufacture. Being made of aluminum and of comparatively light section, it would spring out of place at the slightest provocation.

Fig. 12 shows the piston rings being assembled to the aluminum pistons. The piston-pin assembly is shown in Fig. 13 in which a hand-driven arbor press is used, while Fig. 14 shows an assembling truck loaded with parts for a complete motor.

The type of assembling stand used is shown in Fig. 15, this being indexed in several positions, so as to make every part most convenient for the assemblers. Fig. 16 shows at *A* a type of piston-pin remover for use when for any reason it becomes necessary to remove a pin after the connecting-rod is in place on the crankshaft.

AUTOMOTIVE CONSTRUCTION



FIGS. 15 TO 18. ASSEMBLING TOOLS AND OPERATIONS

Fig. 15—Indexing Assembling Stand. Fig. 16—Special Devices for Removing and Drawing in Piston Pins. Fig. 17—Pistons in Place on Connecting-Rods. Fig. 18—Protecting Sleeves for Pistons.

At *B* is a device for drawing a piston pin into place.

In Fig. 17 the pistons are all in place on the connecting-rods, and as will be seen, the nuts for the cylinder flanges are in convenient position along the side of the crank case. To prevent the possibility of injury, however, the sleeves shown in Fig. 18 are slipped over the pistons. A small flange at the bottom of these sleeves fits inside the cylinder studs and holds the pistons in their correct position. Fig. 19 shows how the manifolds are pressed into position while the nuts are being screwed in place. The arm *A* fits over the studs in the exhaust flange and forms a pivot for the lever *B*, which carries the four-pronged casting *C*. This forces the manifold down into position and the hook *D* holds it firmly in place as long as may be desired. This illustration also shows the form of trucks on which the motor is mounted as soon as it comes off the assembling stand shown in Fig. 15.

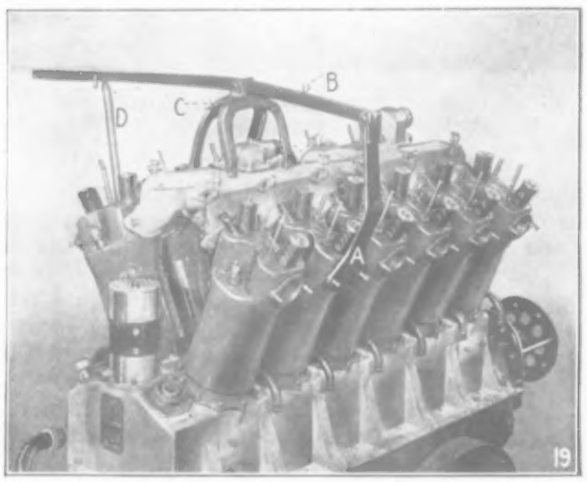


FIG. 19. ASSEMBLING MANIFOLDS

FIG. 20. TESTING COMPRESSION SPACE

AUTOMOTIVE CONSTRUCTION

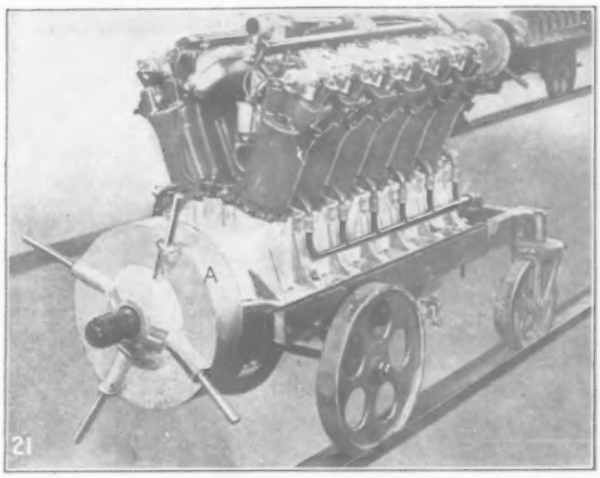


FIG. 21. TIMING THE VALVES

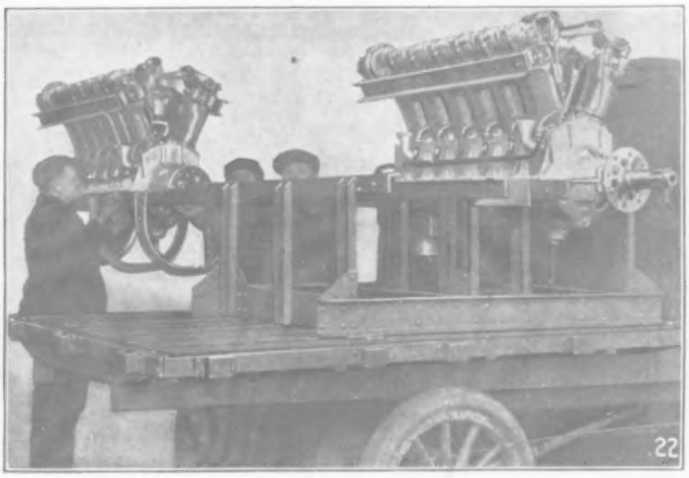


FIG. 22. HANDLING MOTORS AT TEST STAND

Fig. 20 shows the application of a dial gage at *A* to show when the piston is at top of the stroke. The special wedges, *B* and *C* with handles, hold the valves open to relieve compression while turning the motor over.

In Fig. 21 the timing disk is shown in place on the end of the crankshaft so that all the valves may be properly adjusted according to specifications. This is a large disk *A*, graduated as shown, and makes the timing an easy matter. The illustration also shows the form of truck used, as well as the channel iron in which the wheels on one side must track. This avoids the necessity of any attempt at guidance, even though the front wheels are swiveled for use in moving from one department to another.

To Save Lifting Motors

Before going to the test sheds, the motor is slid from these trucks to the frame shown on the motor truck in Fig. 22. This frame holds two motors, and, when mounted on the truck body, is at just the right height to be pushed onto the testing stand so as to avoid all lifting.

The interior of one of the compartments in the test shed is shown in Fig. 23, a motor and testing propeller or club being mounted in position. The substantial iron railing between the propeller and the motor, to protect those who must be around the motor during its operation, and the heavy metal sheathing on each side, show some of the precautions taken against accident.

The Instrument Room

Between the motor-testing compartments is an instrument room, Fig. 24, where are mounted tachometers and indicators to show the speed, the temperature of the cooling water and to give other information concerning the motor while in operation. These are connected to the test room through windows which can be seen at each side of Fig. 23 behind the guard rail and over to the desk in Fig 24. In common with most of the other builders, the Ford Company, was just about reaching its real stride when the end of the war came.

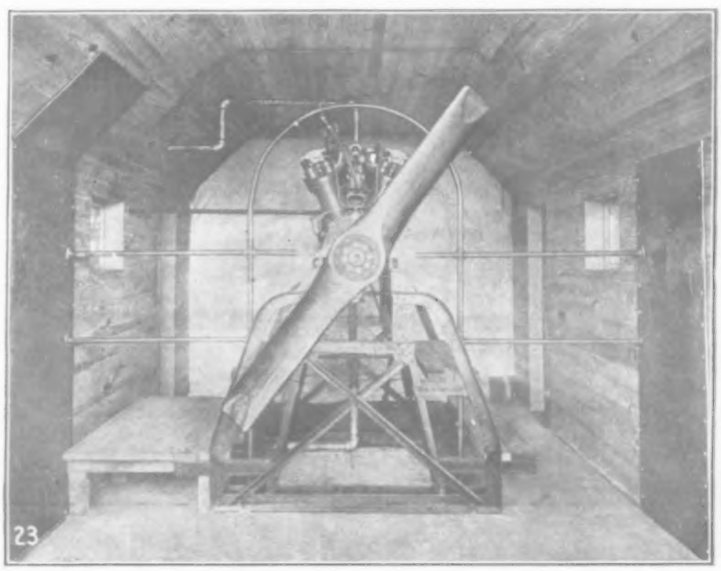


FIG. 23. MOTOR ON TEST STAND

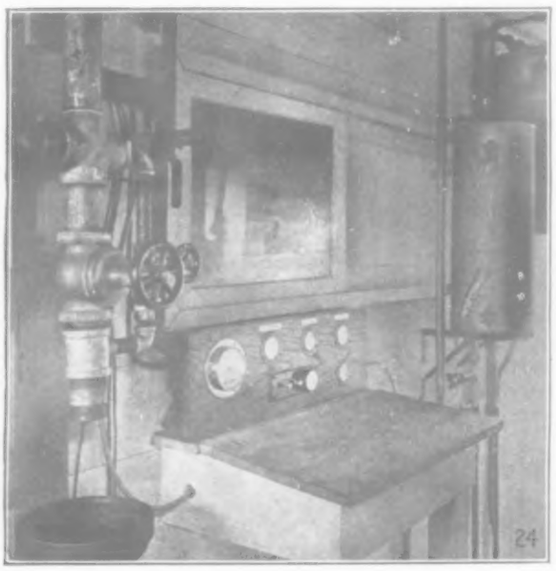
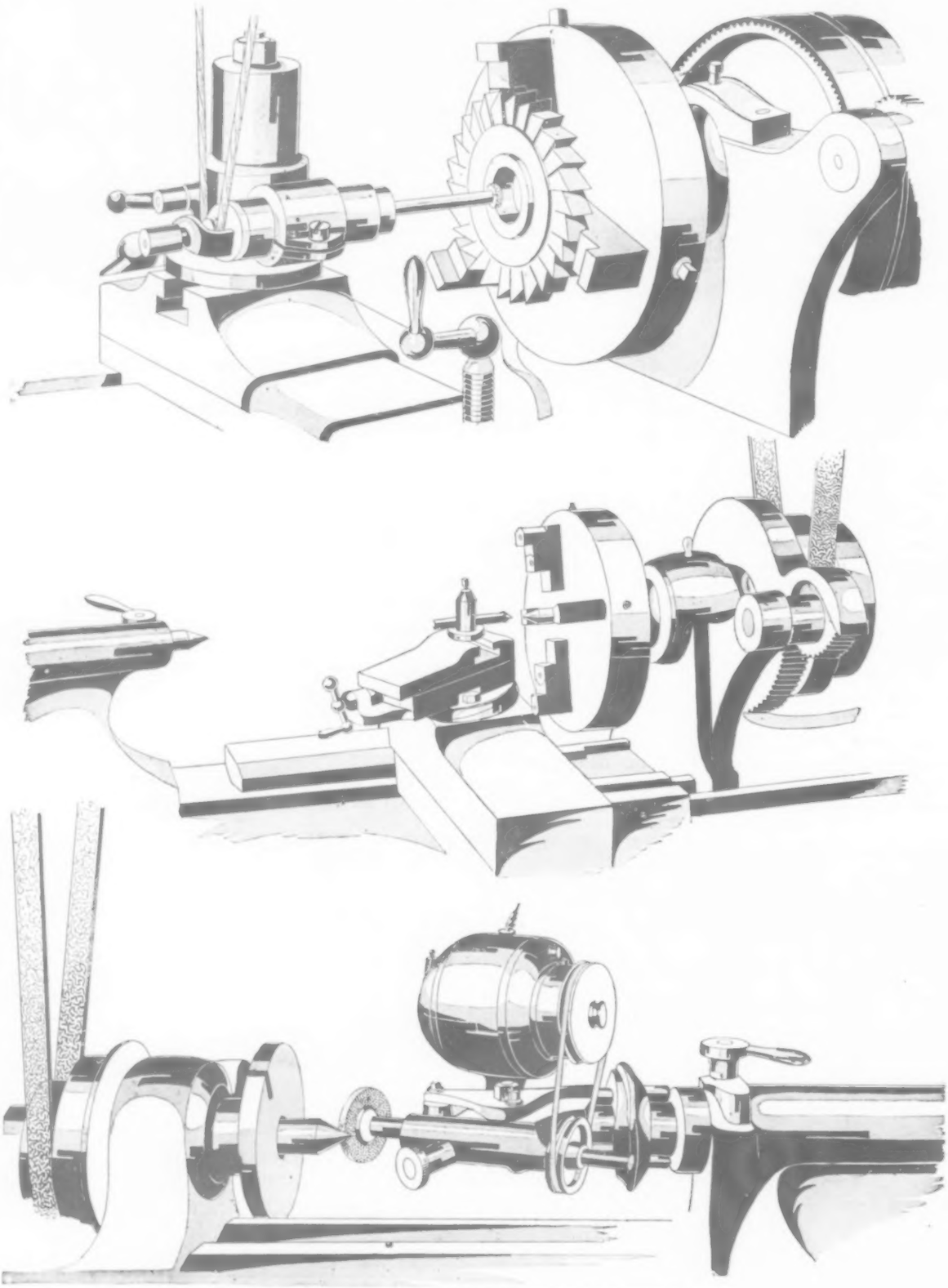


FIG. 24. THE INSTRUMENT ROOM

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



TRUING CENTERS AND GRINDING HOLES IN THE LATHE

The Economical Control and Handling of Patterns in a Large Foundry*

By WALTER D. JONES
The Canton Steel Foundry Co., Canton, Ohio

Important details of a complete and comprehensive system for handling patterns in a large foundry are presented in this paper. The author describes the pattern system adopted by a large steel foundry, in which the patterns go in turn from the pattern storage to the sketch and checking room; from the checking room to the active floor; from there to the foundry to be molded and finally are returned to the storage section after being released from the foundry. The movement of the pattern through this cycle is governed by five cards, the functions of which are fully described in the paper. The author claims that by use of this method the plant now enjoys intelligent direction, and awakened keen interest.

EVERY foundryman knows the problem presented in attempting to deliver the pattern and the corebox to the foundry on time, correct according to the blueprint, and in relation to the promise date of shipment; to return them to the pattern storage the instant the foundry releases them; and to properly place them in the pattern storage section and shelf, where they will be found when wanted. The familiar sight of hundreds of patterns littering and cluttering up the passageways in and around the foundry and the oft-repeated alibi as to why a pattern is there or is not there, as the case may be, is sufficient to recall to the mind of all the confusion which exists in most of our foundries today.

A complete description of the methods adopted at the plant of the Canton Steel Foundry Co., together with illustrations of forms, etc., appeared in the May 15 issue of *The Foundry*. Anyone whose interest is aroused in this brief outline of our pattern control system is referred to the article mentioned. The photographs of the various forms used will help to make clear the explanation of our system here offered.

Offices Are Concentrated

The development of the plan made it necessary to bring together the various offices so as to coördinate the work. Therefore, a very important link in the chain is the arrangement of the offices of the superintendent, order, production, dispatcher and checker, which are located in the main pattern storage building. The pattern shop is adjacent to the pattern storage building. The arrangement of these offices permits of easy access to one another with a minimum loss of time. Immediately outside of the checker's room is the active floor. This is so called on account of the fact that here are stored all patterns which have been checked and sketched and which are waiting their turn to be sent to the molding floor of the foundry.

All blueprints are filed in the sketch room where they are available for reference. The official list of patterns is very much the same as that of other foundries and serves the purpose of locating the section and shelf where the pattern is stored. Before the order is written, the pattern storage section and shelf are shown on the customer's purchase order. This information is in turn copied on the regular order blank as well as the operation cards. If the index shows that the customer's pattern is not in storage, the production department is immediately notified, which in turn takes the question up with the customer and follows the matter until the pattern is received. The dispatch clerk is notified upon arrival of the pattern.

Movement of Patterns Through Plant

The cycle of movements of the patterns for each order are four. These movements are as follows:

First: The patterns are removed from the pattern storage to the sketch and checking room.

Second: The patterns are checked and sketched and removed to active floor.

Third: The patterns are transferred to the foundry to be molded.

Fourth: The patterns are returned to pattern storage section and shelf after being released in the foundry.

At the time the order is received it is known that each pattern called for on the order must go through these four operations and it seems to be the best practice to write the operation cards covering these movements at that time. These cards are then held until the order is ready to go into the foundry, when they are released to the various departments as outlined in the following paragraphs.

How Operations Are Recorded

The method of recording these operations is as follows: The sticker (master copy) has provision for four orders, size 13 x 8 in., the sheet being in effect four reproductions of the same form separated by pinhole perforations. After the four orders are recorded the sheet is complete and is then used as a master copy on the duplicating machine for reproducing the other four copies. The forms, 6½ x 4 in., are then detached and made into sets. The sticker is further reduced, the actual size when placed on the pattern being 4 x 3 in. Each set has five cards, four of which cover the movements of the pattern which comprise the cycle described in previous paragraph, and the fifth being a record card on which these movements are recorded.

Each of these forms contains the same information, including the date entered, job number, order number, name of customer, customer's order number, pattern number, storage, section shelf, description, quantity ordered, promised date of shipment, special steel (if called for), number of coreboxes, and classification.

The operation cards referred to and the purpose they serve are as follows:

1. Pink transfer card—It routes the pattern out of the main storage. This card is replaced on the pattern after the pattern has been sketched and checked

*Abstract of a paper presented at the annual convention of the American Foundrymen's Association, Philadelphia, Penn.

and remains on the pattern until the pattern is sent into the foundry. It is removed at that time and returned to the control desk and serves as a notice to the dispatch clerk that the pattern has been sent to the foundry.

2. Sticker—The sticker is shellacked on the pattern after the pattern has been checked and sketched. By means of the sticker the pattern is identified on its arrival in the foundry by the foundry foreman and is assigned to the molder.

3. Mold card—This card is sent to the foundry clerk at time pattern is sent to the foundry; on it the time of molding the pattern is recorded.

4. Green transfer card which accompanies mold card—This card is tacked on the pattern when the job is completed in the foundry by the foundry checker; it covers the return movement of the pattern to the pattern storage.

The Control Desk

5. Pattern transfer record sheet which is kept in control desk.

The operation of the system is under the control of the production manager. It is in the dispatch office, however, where the actual movement of pattern is controlled. The dispatcher keeps all operation cards in a desk which was designed especially to meet this particular problem. The desk has six filing units, and each unit has 24 leaves, four clips on each leaf. The lower section consists of four drawers divided into sections and provided with numerical tabs from one to 300,000. (Nothing below the even hundred is recognized in the index.) It first must be understood that each order has a promise date of shipment on it which is also shown on all of the operation cards. It is a standing order in our shop that the patterns must be sent to foundry and work started at least three weeks before shipping date shown on order, and unless definitely ordered otherwise, this procedure is followed. The dispatcher files all operation cards according to the date they must be sent to the foundry. Three days before this date the dispatcher releases the first operation card. This card is an order to the pattern storage foreman to send the particular pattern called for to the checking room. The dispatch clerk inserts the date in space provided on pattern transfer record and files it according to pattern number in the active pattern file.

Immediately after the pattern has been sketched and checked the chief checker obtains from the dispatcher the sticker and pastes it on the pattern. The sticker shows the number of coreboxes and loose pieces required so that this important feature can be checked upon arrival into the foundry. At the time of checking, the loose pieces are nailed in proper places on the pattern. The dispatch clerk withdraws the record card, inserts the date pattern was checked and refiles the record card.

Outlining Provision of Patterns for Next Day

The pattern is then sent to the active floor where it waits its turn to be sent to the molding floor. Before the close of each day, the dispatch clerk hands to the pattern storage foreman a list of the patterns which are to go to the molding floors for the next day's work. This list is built up in diary form by the dispatch clerk currently. At the same time the dispatch clerk sends to the foundry clerks of the various floors the corresponding mold cards together with the "return" card (No. 4 of the set, green). These cards are filed in the offices jointly occupied by the foremen and foundry clerks of the respective molding floors so that the foremen and clerks know at all times the work in hand and ahead, and can plan accordingly. As the patterns are tallied out into the foundry the dispatcher inserts the date on the corresponding record cards.

The dispatcher is able to get an absolute check as to whether the pattern storage foreman has sent the correct number and the right patterns into the foundry by means of the pink card (No. 1) which remains on the pattern until the pattern is sent into the foundry and is then detached and returned to the dispatch clerk who in turn checks it with the daily list, to see whether the work is properly performed.

As fast as the patterns are released by the foundry they are returned to the pattern storage, and on arrival there they are returned to the proper section and shelf.

The green card is then detached and forwarded to the dispatch clerk who again refers to the record card and inserts the date that the patterns were returned to storage and removes the record from the active pattern file. This card is then sent to the production office where it is filed according to pattern number as a permanent record. All of the other cards are destroyed as the operations are completed. This completes the cycle.

Advantages of Filing System

In regard to what is accomplished by filing the record card according to pattern numbers: In the opinion of the writer, it is important to have some method of bringing together by pattern number, all of the orders on which the pattern must work. This method insures that the pattern is molded in sequence according to the production schedule and promise of shipment date. Moreover, the pattern is not returned to storage until the production cycle for orders in hand calling for this pattern are completed. Also, by this method, it is possible to plan in advance for changes which are sometimes necessary to make on the pattern.

Under the plan the dispatch clerk first files the record card by pattern number. He is therefore immediately in possession of the vital information as to whether the pattern is tied up on other orders; whether the volume of orders calling for a particular pattern warrants the making of an additional pattern; and which of all the orders calling for the pattern should be given priority. In addition, the active pattern file reveals automatically the active orders in the foundry, the date the patterns were sent to the foundry and the order became active, and the location of the pattern at all times. This file record is a very simple one and can be expanded to take care of an unlimited number of patterns.

Much of the lost time in foundry production is directly traceable to improper and careless handling of the patterns. What this company has attempted to do is to reduce the problem to a standard practice. The best proof that can be offered as to the merit of the plan outlined in meeting the problem at this plant lies in the different attitude of the men who do the work. We now have intelligent direction, awakened and keen interest, and mind work instead of tongue work. We get facts instead of alibis.

US ARMY ORDNANCE NEWS

The Manufacture of Artillery Range Finders

By GEO. H. THOMAS

Accuracy in gun fire depends in general on four things: a knowledge of the velocity of the projectile at all points in its flight; the definite distance from the gun to the target; the angle to elevate the gun so that the projectile shall reach the target before the force of gravity brings it to the earth, and sights for pointing the gun in the proper direction. The first of the requisites is calculated from the laws of ballistics for each type of gun with its particular load. For the second and third, mechanical means for solving trigonometrical functions are necessary, and for the fourth a telescope or other like instrument of precision must be supplied. The three latter articles must be made with the utmost exactitude and it is the purpose of this series of articles to describe the theory and processes employed in manufacturing such instruments in this country and in France.

THE manufacture of range-finding instruments was as important a part of the war program as was the making of guns. Without these instruments the gunners would be inefficient, if not helpless, in modern warfare. This apparatus is to the artillery what eyes are to the army and are properly called gun sights, a combined function being to estimate distance and to register the elevation of cannon for the distance so prescribed. This apparatus consists essentially of precision instruments, the manufacture of which calls for exactitude in their construction far beyond any average mechanical device.

The "laying of the gun" is that process in field practice which disposes the gun in setting an elevation in regard to the target. When the target is visible and the distance known, the process is called "direct laying." When the target is invisible, by reason of distance or intervening landscape, the disposition of the gun depends on the process of indirect laying involving trigonometric calculations and the use of range finders.

FIG. 1. DETERMINING THE RANGE BY TRIANGULATION

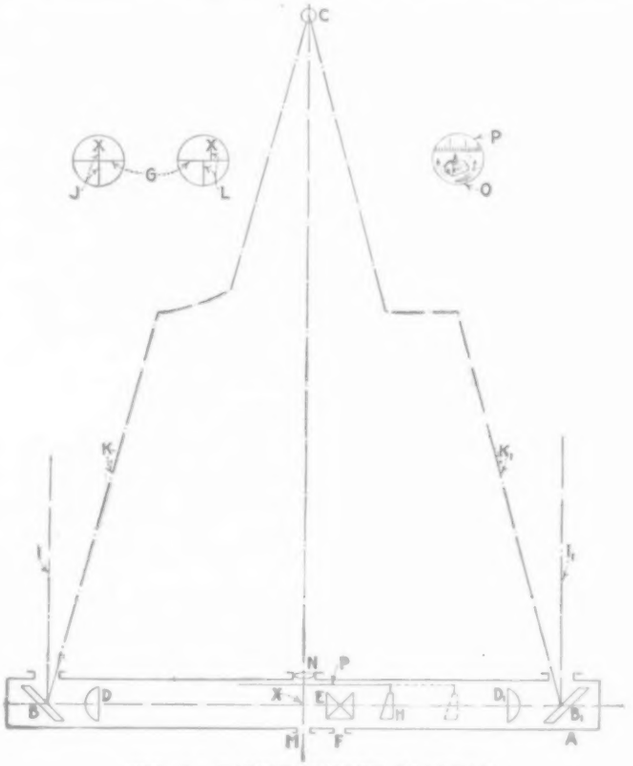


FIG. 2. RANGE-FINDER DIAGRAM

These instruments automatically solve triangles and as a rule a right-angle triangle, whose base is known, and one side of which is a firing range, is employed. An objective point whose remote distance is an unknown quantity may be the apex of a triangle whose base is either the length of the instrument itself or the known distance to a point related to the position of the instrument.

For example, let *A* in Fig. 1 represent the position of a field piece and *B* its objective. Then along line *C* in any suitable direction may be selected a point whose distance is known. If means are provided at *C*

ARMY ORDNANCE NEWS

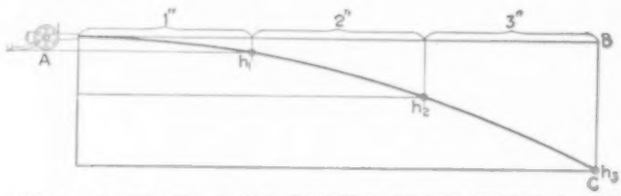


FIG. 3. PATH OF A PROJECTILE FIRED FROM A GUN HORIZONTALLY DISPOSED

to record the angle reading there, the triangle may be solved for the firing distance *A-B*.

The principle of the range finder is shown in Fig. 2. The long tubular member *A*, whose extreme length can be the base of any triangle, is mounted on a tripod at *X*. At the ends of tube *A* are two reflectors *B* and B_1 which deflect the rays from the target *C* through the objective *D* and D_1, and the prisms *E* to the observer's right eye at *F*. The field of the eye piece *F* is divided by a horizontal line *G*, above which is the image from *B* and below it, that from B_1. Since the angle formed by the rays at B-B_1 would be infinitesimally small in a triangle whose apex, the firing point, is often a matter of miles, mechanical means of moving the reflectors are out of the question. Therefore, a movable prism *H*, which effects a stereoscopic coincidence, is used. This prism *H* is neutral at this position and the rays *I* and I_1 from a very distant object, will form a continuous image as at *J*. A nearer object will change the position of the ray *I* and I_1 to that of *K* and K_1 and the image in the field *F* will be discontinuous as at *L*. The prism *H* is then moved to the right until the image at *F* is continuous. Through the left eye piece *M* and its objective *N*, the observer sees the target *C* as shown at *O* and above it the scale *P*, which is attached to *H*, from which the range is directly read.

FIG. 4. GUNNER'S QUADRANT

After the range is obtained, the next step is to determine the proper degree to elevate the gun in order that the projectile will reach its mark. It will be recalled that as the projectile leaves the muzzle of a gun, horizontally disposed, that the force of gravity tends to pull it down and that the path described by the projectile in this combined horizontal and downward flight is that of a parabola. It passes over equal spaces in equal times but falls with accelerating velocity, according to the formula $h = \frac{gt^2}{2}$ in which *h* is the height fallen through *t* which is the time of the flight and *g* the force of gravity. Assuming that it will take three seconds for the projectile to travel from *A* to *C*, Fig. 3—If the gun is horizontally disposed, the projectile would fall according to the formula in the first second of its flight a distance of h_1 or 16.1 ft., in the second interval it will fall a distance of h_2 or 64.4 ft.; and at *C*, or the third interval, the total fall of the projectile would be 144.9 ft. It is evident, therefore, that the gun must be elevated and the degree of elevation is determined by use of the Gunner's Quadrant shown in Fig. 4.

The highest development of range-finding instruments for field use is the Panoramic Sight *A* shown in Fig. 5 which is mounted on a Quadrant Sight *B*. The panoramic sight is an admirable instrument of optics and dials that record angles both horizontal and vertical and is so called from the peculiar capacity the instrument possesses to sweep the entire horizon in search of a line of evidence independent of its fixed position. The instrument shown in the illustration is the French model manufactured by the Societé D'Optique of Paris. It is of recent development and its addition to artillery equipment is one of exceeding value.

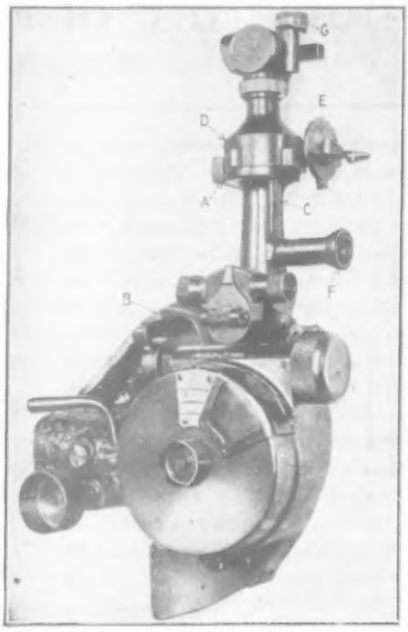


FIG. 5. FRENCH COMBINED PANORAMIC AND QUADRANT SIGHT

It will be seen that the device comprises a base stem adapter *C* and above the stem a chamber *D* containing a geared arrangement equipped with a worm-shaft and a dial *E* to record fractional revolutions of the chambered gear, which are identical in character with the optics mounted above. By means of an unique system of lenses, prisms and dials, the observer looking through the telescopic sight *F* can search in any direction for a mark of evidence. The reading of the dial *E* affords information for range computation and the reading at *G* shows the relative vertical position of the gun and target. The unit of graduation of the dials is a *mil* which is $\frac{1}{6400}$ of a circle.

Directly associated with the panoramic sight is the

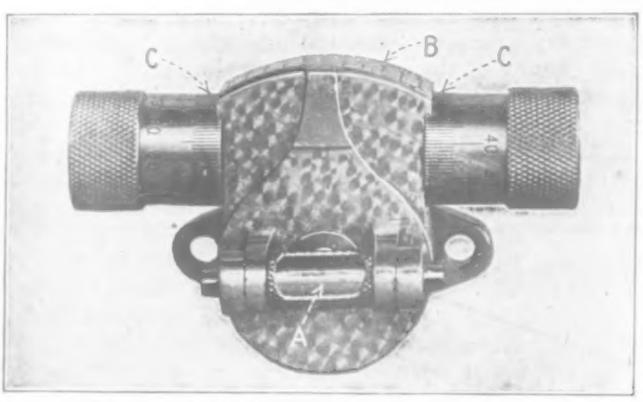


FIG 6. ANGLE OF SITE

quadrant sight *B*, Fig. 7, mounted on the axis of the gun carriage. In this instrument are dials and recording drums which are visible through the windows *C* and *D* and relate to the linear distance between the gun and its target; the disposition of the gun at proper elevations for long-distance firing and high aims, and the power of the charge for the range at hand.

An important complement of the instrument is the Angle of Site, which is shown at *B*, Fig. 7, and in Fig. 6. Any displacement of a gun carriage is readily detected in the spirit level *A*, Fig. 6, and the correction necessary to rectify the error is determined by means of the scale *B* and the micrometer dials *C*.

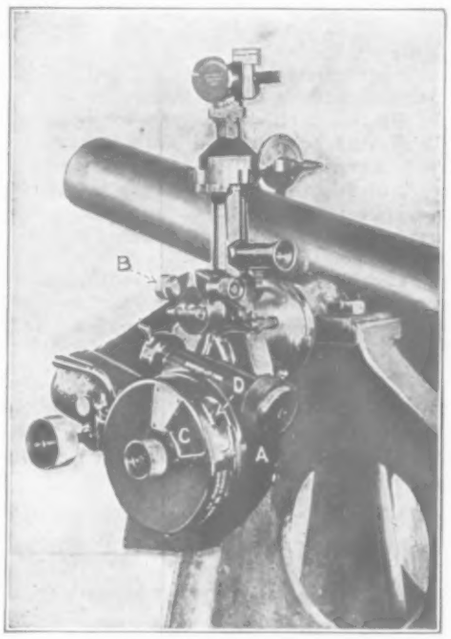


FIG. 7. A RANGE FINDER MOUNTED ON A GUN CARRIAGE

It will be noted that the French design of this instrument is full of curves, intricacies and oddities suggestive of baffling operation. In detail, it presents perplexing problems in mechanical manufacture. Yet it is a thing of beauty, as a manufactured article, and as a whole partakes something of the nature of the French for characteristics of design. However, it remained for American ingenuity to simplify the design in order to produce this instrument of precision on a quantity basis.

What Is a High-Grade Machine?

BY W. OSBORNE

In the *American Machinist*, on page 285, there is an editorial under the title, "What Is a High-Grade Machine?" It is one thing to sit down and think out what we should mean when we call a machine "high grade" and it is often something else when we think over the things which we have spoken of, and often thought of as high grade. Much too often we use the term as though it was synomynous with costly or high priced, and much too often we call work done to close limits high grade without regard to what would be the best limits for the use to which the work is to be put.

As grading is arranging according to quality, a high-grade machine would be one that was above the average, the trouble being in giving proper values to the things which go to make up the machine so that its grade may be established. And it is altogether likely that each of us has a set of standards of his own and so the term "high grade" may mean something different to each one of us.

Women have been making their mechanical marks in our shops for some time past, so I approached a very able and clear-headed one with the question "What would be your definition of a high-grade machine?" Her answer came without hesitation. "One that did everything that it was made to do in a first-class manner."

That seems all right at first, but when one keeps on thinking, the thought comes that perhaps there may be "high-grade low-grade" machines, and also "low-grade high-grade" machines.

A cornshelling machine may be a very low-grade machine to the man who makes micrometers; yet one make of cornshelling machine may very much out-rank other makes and among cornshellers it may well be considered high grade. And yet the man who makes the cornshelling machines may get a micrometer that is so much poorer as a micrometer than some other micrometer, that he would unhesitatingly call it a low-grade "mike" and be justified in doing so. But in classifying machines into grades, a cornshelling machine would be put very far down from the micrometer.

There is a well-known machine that has wonderful belt power. It has efficient tool arrangements. It is intended for quantity production. Put up the work to reasonably near to the belt power and tool endurance and you quickly discover that the designer left several weak points between the belt and the tools. To keep that high-priced machine going a reasonable part of the time it is necessary to cut the rate of production about one-third.

After such a fact had been demonstrated, how many mechanics would consider that machine a high-grade machine, or how many designers would consider the design a high-grade design?

After a new machine has been coddled along for weeks by a skilled workman only to have it give trouble at a very inaccessible bearing where a close fit is not of any advantage, does it ring true to have a salesman claim that the machine is strictly "high grade" because both hole and shaft are inspected to close limits?

Consider the matter of finish. Finish will fool more of us into thinking a thing is higher grade than it really is than any other one thing. And we do our judging by how the machine looks when it is new. What will it look like when it has had its intended use for a good part of its reasonable life? Then is the real time to judge of it, but how many of us think of it when looking at an old machine, or wonder what the nice new machine will look like when it has been in service for a while.

A high-grade design would take in all the details of the machine. High-grade material would be material well suited to its place in the machine, and the same would be true of the degree of refinement of the workmanship. Micrometer work on a cornshelling machine is as truly low grade as cornshelling work is on a micrometer.

This last statement brings out one truth. So-called "good work," that is, close, accurate and refined work, raises the grade of a machine up to a point. If it goes too far in closeness, or accuracy or refinement, it lowers the grade. The point at which the grade quits rising and begins to fall depends on the machine, as it is not the same for all machines or even for machines of the same kind but intended to be used under different conditions.

When refinements are carried to the point where they are a detriment to the user, or where they increase the cost unreasonably for any benefit which they may bring, the grade is being lowered.

There is one place where I have never heard of the grading comparison being used but where it should be. If several manufacturers were making a machine identical in every way the one who could make it and sell it for the least money would be of the highest grade.

By J. P. Brophy
Cleveland Automatic Machine Co., Cleveland, Ohio

A high-grade machine should be considered from the standpoint of durability and services rendered; high grade in appearance, combined with the real essential wearing and producing qualities. But beauty of design is not what we should pay for. A high-grade article that deserves the name should give results as an investment commensurate with its cost.

Man and a machine in some respects are synonymous. A man born of good healthy parents, who at the age of 25 or 30 is physically perfect, will, if he does not abuse himself, keep in good working condition for many years in the future. The same may be said of a high-grade machine because it will produce for a great number of years successfully if given anything like the proper attention. The man and the machine who are high grade will not require the doctor's or the mechanic's attention if care is exercised as time elapses, but we all know that man ages and so does the high-grade machine. The man who was not physically right to commence with, this means organically weak, and the machine that was poorly designed and made with inferior material or workmanship, when attempting to produce the maximum from a high-grade standpoint, would both prematurely reach the scrap heap.

The engineer should know how to arrive at the proper dimensions or his machine does not deserve to be called high grade. A 1-in. shaft should not be used where a ⅝-in. shaft is big enough for the work. Too close workmanship on parts that do not require it does not produce high-grade machines, though the working parts must have surfaces large enough not to require replacing until the machine has given many years of service. A high-grade machine should keep on producing with the working parts wearing out slowly and evenly. This means that machines should become aged showing no particular weakness in any location.

What was considered right in the selection of material 15 years ago would be wrong today. High-grade material with the right qualities for strength is now essential to a high-grade machine.

A threshing machine is very common when making comparisons with other machines. However, we have high-grade threshing machines from the outside woodwork to the inside mechanism.

Measuring machines of the kind that can be depended upon when kept in a room the right temperature, are positively high grade. Printing presses used by newspapers are in the high-grade class, both in design and workmanship. Many machine tools are high grade from the standpoint of pleasing design, rigidity, long life, interchangeability, good material and the best obtainable workmanship. Large telescopes used by astronomers to scan the heavens must be high grade; otherwise, they are perfectly unreliable and useless.

It will be well to keep in mind the following when thinking of high-grade machinery:

1. What is the machine intended to be used for?
2. The careful study by the engineer of what shape and size the machine should be.
3. A layout by the draftsman to determine if your ideas are right or wrong.
4. Accuracy of the work to be produced, which means considering the shape and strength of the parts required, deserves great consideration.
5. Have as few pieces in the construction of the machine as possible.
6. Accessibility of the working parts and not too intricate a design.
7. Work should be as nearly interchangeable as common sense dictates, avoiding as much hand labor as possible.
8. Care in lubrication. Oil holes should be large enough and within easy reach of the operator and oil cups should be used where possible.
9. Selection of material deserves great care on the part of the designer because of his knowledge of what the machine actually is intended for.
10. All working parts should be hardened and ground to insure good wearing qualities and consequently long life.
11. Don't overdo in weight because material improperly distributed is useless and costly.
12. Test machine to the maximum in endeavoring to discover weak points.
13. Don't be in a hurry to market a supposed high-grade machine. Keep it in operation in your own or some customer's place of business until all doubts of its success are removed.

The upkeep must be at a minimum on high-grade machines. When such machines are so old they finally reach the scrap pile, the owner should feel reluctant to part with them because of the gratifying services rendered.

Rules of Etiquette To Be Observed in the Machine Shop

By Charles Eldridge

The article by Jack Homewood on page 756, under the above heading, is interesting and as good a bit of satire as has been published in the *American Machinist* for some time. However, whether one is writing fact or humor for a technical publication he should stick to facts.

I have in mind the statement about the platen running off the planing machine. Did anyone ever see the platen run off its ways and fall onto the floor? I have worked in 50 machine shops in my time that I can recall the names of and many more that I have forgotten; I have run as many different planing machines as any machinist of my age and varied experience, but I have never seen the platen run off the ways, though many times I have seen the reverse dog slip, causing the platen to run out of gear.

The story about the platen running off its ways is a clever bit of fiction invented some 30 or more years ago as an interesting tale to tell junior machinists while they are not busy looking for left-hand monkey wrenches, putting on tools, square drills, etc. It is a harmless little joke, to be sure, but it seems rather strange that Mr. Homewood should run it into his article because it is out of all reason; an impossibility that could not happen.

[The "impossible" has happened several times under the editor's personal observation—once (more than 30 years ago, too) to himself. It is necessary only to have an old-fashioned planing machine with a short bed, and a piece of work that is heavier at one end than at the other.—Editor.]

A JAPANESE SHIPYARD

Special Correspondence

THE illustrations give some idea of the shipyard development in Japan, the illustrations being from the Osaka Iron Works. These works are among the three largest devoted to shipbuilding in Japan.

The headpiece gives a general view of the yard with a 6000-ton cargo boat at the extreme left, the keel plate of an 8000-ton boat being laid in the next slip, a boat of similar capacity nearing completion in slip 3, and the rest not being visible in any detail. It will be noticed that the slips grow somewhat shorter as they go to the right, but the largest one is capable of handling a 10,000-ton boat if necessary.

Fig. 2 shows the erecting shop, which is 50 ft. wide, 500 ft. long and 40 ft. high. Eight sets of engines are being erected in the view shown. Part of the machine shop is shown in Fig. 3. The large vertical planing machine on the right has a capacity of 12 x 25 ft. and is machining a bedplate for the engine

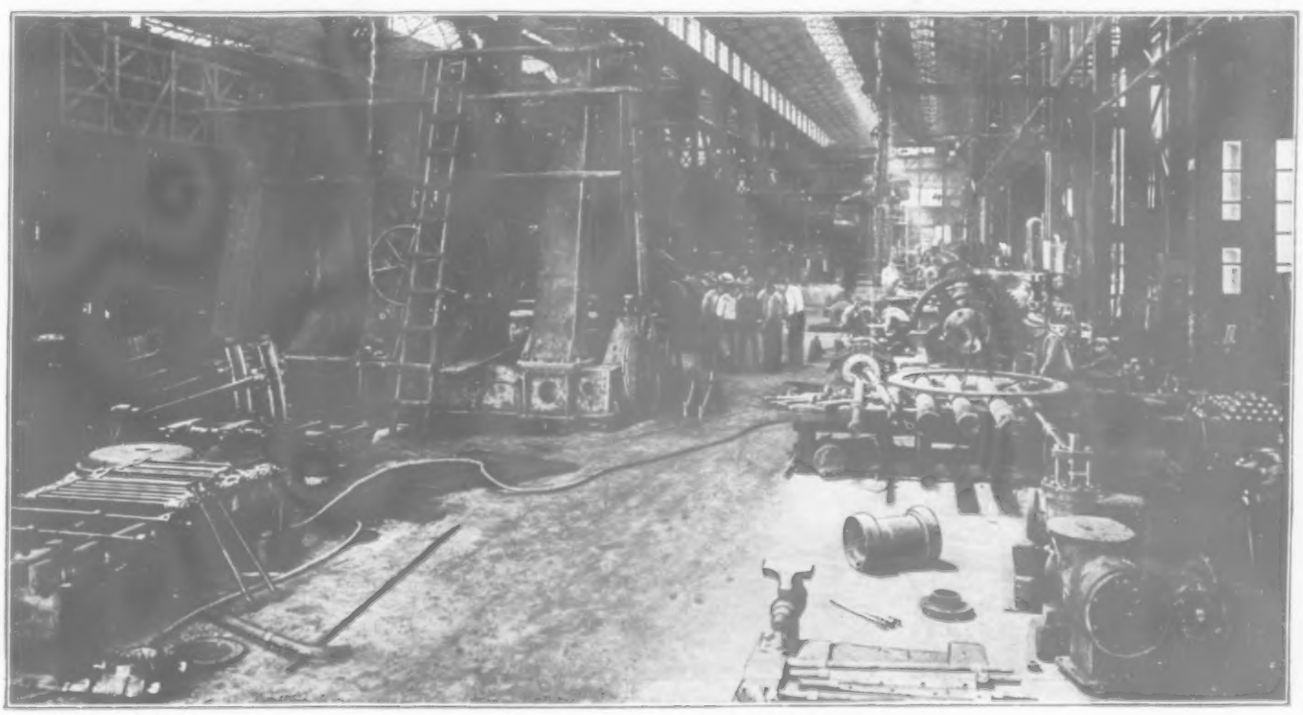
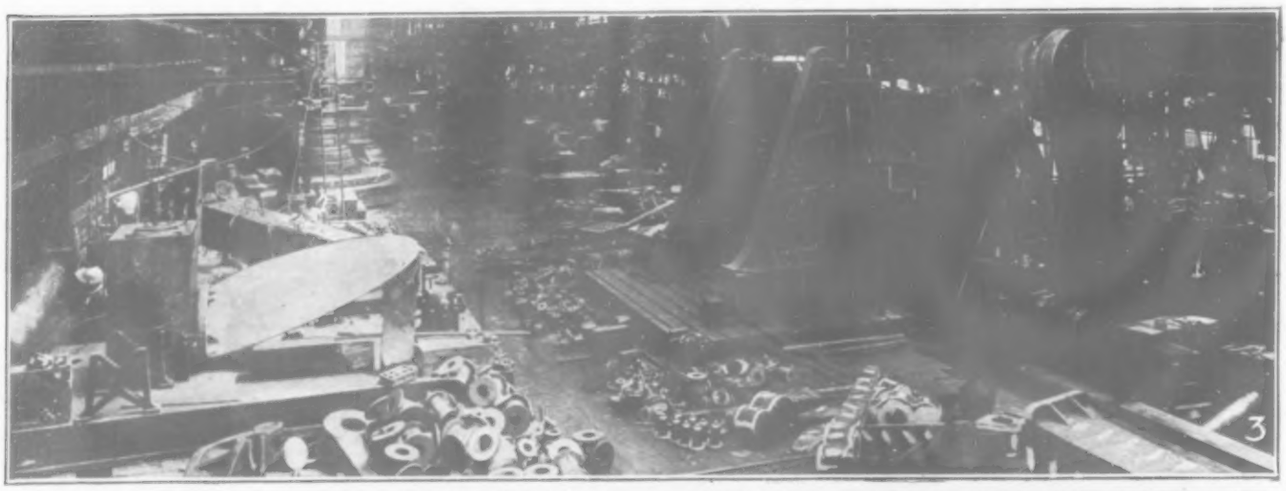
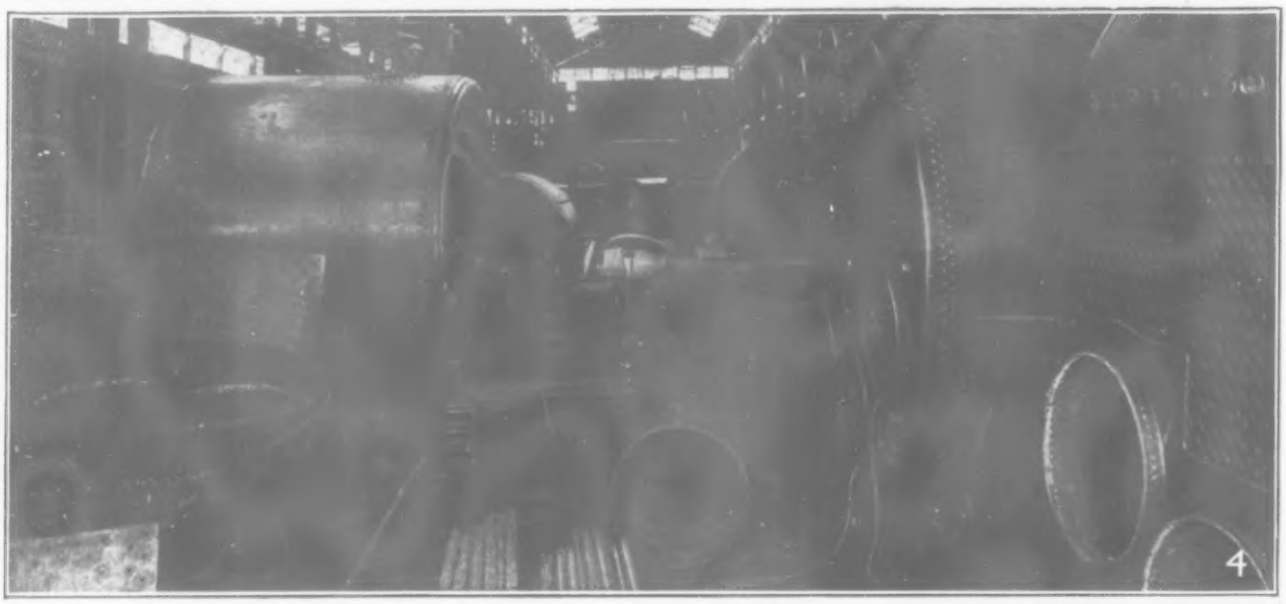


FIG. 2. THE ERECTING SHOP





FIGS. 3 TO 5. MACHINE AND BOILER SHOP AND THE FOUNDRY
Fig. 3—Part of the machine shop. Fig. 4—The boiler shop. Fig. 5—In the foundry.

for the 8000-ton boat. On the opposite side of the shop a propeller blade is being laid out, while farther down the line is a 16-ft. vertical boring mill. This bay is also 50 ft. wide and has two 20-ton traveling cranes. There are about 400 machines in the shop.

The boiler shop, Fig. 4, gives a good idea of the types of boilers used as well as their component parts, the corrugated furnaces being shown in the center. This shop is 48 ft. wide, 400 ft. long and 35 ft. high. It is served by two 10-ton cranes and can turn out six boilers of the type shown, 15 ft. in diameter by 12 ft. long, a month. The foundry, Fig. 5, is 300 ft. long and has a center bay of 40 ft. and two side bays of the same width. There are seven cranes in all, two of 30-ton, three of 10-ton and two of 5-ton capacities, in addition to the jib crane shown. This foundry has a capacity of 600 tons a month.

The smith shop shown in Fig. 6 is 200 ft. long and 48 ft. wide, consisting of two bays. The equipment is two 1-ton steam hammers, three 1000-lb. hammers and four 500-lb. hammers. In addition to this they have separate shops with hammers of varying capacity. The entire plant covers an area of about 58 acres.

FIG. 6. THE SMITH SHOP

Johnson Talks to His Foremen

BY JOHN R. GODFREY

I happened to drop into Johnson's office the other day to see what was new in his management schemes. But I only got as far as the ante-room, because I heard him having a heart-to-heart talk with a couple of his foremen. I couldn't help overhearing parts of it and, as it hit several important points in getting on with men, it's worth passing along. The seance didn't have any special fireworks but it was full of pep and good sense just the same.

"The main thing I want you men to remember is that you are representing me and the firm to the boys in the shop. Whenever you feel like saying something cutting and nasty to some fellow you don't like or who has made a mistake, just stop and think whether it will help the firm any to have you get a little of the venom out of your system.

"Every time you are unjust in any way to one of the boys, he puts the whole firm on his mental unfair list. He doesn't stop to think that we may not know or approve of what you do—he takes it for granted that we want you to do it. Every time you are unfair it costs you the respect of your men and it costs us more dollars than any of us realize, because a man with a grouch, especially when he knows it's justified, hinders production in a dozen ways. He just naturally can't take full interest in his work; he tells his chum, and, before you know it, there's a dozen men, mighty good fellows too, feeling sore at me and the firm, and the work drags. Of course they cuss you good and plenty, but they really lay the blame on me and we pay the bill.

"You boys have got to learn that the foreman's job is a dern sight more important than it used to be. That's the reason we are paying you more money than any of us ever dreamed of in the old days. We've learned how necessary good foremen are to the business and you've got to realize it too, or else let some one else do the job. I know you both well enough to believe you can do it when you get the right slant on the situation.

"We want to build up the best working force in the country. But we can't do it unless every foreman's relations with his men are fair and friendly in every way. A cranky foreman can do more to upset the

apple cart than any one thing I know of. You've got to be bigger men than to let personal prejudices affect your fairness. Whether a man belongs to your church, or your political party, or your club, or your nationality, must have absolutely nothing to do with your treatment of him. Even if your wife thinks his wife dresses too well, it doesn't count at all. Every man who doesn't agree with you or with me, isn't necessarily a fool or a danger to the shop, or to the community. We're too fond of calling a man an anarchist or a Bolsheviki if he happens to remark that you get too big a salary, or me too big a dividend. We don't agree with him of course, but there's a bare chance that he may be right in both cases.

"What I want of you men is to treat the men as you think I'd treat 'em if I was in your place, or as you'd like to be treated. I'm no angel and I sometimes let loose a barrage of cuss words, under provocation, of course, but I'm dead sure the boys know I'm playing fair according to the present rules of the game, and I don't want them to lose faith in the 'old man.'

"What this shop needs and what the whole world needs right this minute, is more production. More machines are needed to help make more shoes and clothes and farming implements. More of our motors are needed for many purposes. But don't get the notion that machining methods and machine speeds are all there is to production. They're mighty important of course, but they don't cut much ice unless you have the hearty coöperation of the rank and file of the men.

"This coöperation often means just the difference between a man doing just enough to hold his job, and not doing enough to get out real production. And this attitude depends more on the personal attitude of you foremen and the way you get on with the men, than anything else.

"Just try and put yourself in the other fellow's place whenever you feel tempted to bawl him out for some mistake, for some act you don't like, or for any other reason. Of course, you've got to maintain a fair amount of discipline, but with the men interested in the work and the output, it doesn't take much policing to keep things going as they should. If you know that Jimmy Brown has a sick youngster and has probably been up half the night with him, make it as easy for him as you can 'till the boy gets well. His production may drop a little some days but he'll more than make it up when he gets his regular sleep. Just be as human as you'd like me to be if we were back in the little old shop. The size of the shop makes some difference in the way we have to handle things, but if we let it cut out the human touch with the men, we're going to lose more than we gain.

"I know the men aren't all angels by a long ways. Some of 'em would kick no matter what you did, or how. We've got to take men as they come and make the best of it. But let's be dead sure the kick hasn't a foundation before we get too harsh with the kicker. If he's just a natural born troublemaker who won't appreciate good treatment and doesn't want to pull with the bunch, we'll have to find some way of letting him know that the best way he can improve the shop is to leave it. But we want to be extra careful to play fair in such cases. The worst thing we can do is to give any man a chance to be a martyr—for we all have a tendency to sympathize with the under dog.

"Don't forget that both your departments dropped back a bit on production last month, that several men asked to be transferred to other departments and that you could feel the grouch even in walking through the shop.

"I'm not asking you to kiss 'em 'good morning' when they come in or to remember the names of all the kids. But I am asking you to remember that they are human; that we all make mistakes; that part of these mistakes are probably our own fault for not making instructions clear or for not properly instructing the men; that if perfection were necessary we three would be out of a job.

"There's a little rule that is older than history, that has been preached by the wise men of all ages and all religions, that will do more to straighten out our industrial tangles than anything else. It's the 'do as you'd be done by' rule that nobody has a patent on, but that isn't used often enough to keep it from getting rusty. Let's try and play the game so well that we can have the pick of the best men in town.

"When I don't keep up my end, just come and tell me where I fall down and I will try to fix it. You are closer to the men and can do a lot to help things along."

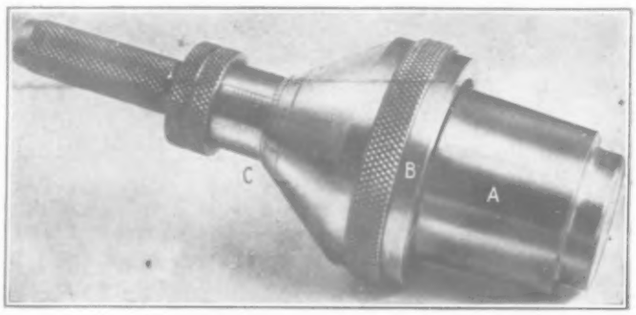
I ducked just before they came out so I wouldn't have to discuss the question with Johnson because I didn't know just what to say. He'd covered the ground so thoroughly that there wasn't much left to talk about.

Testing Tapers in Roller Bearings

By I. B. Rich

The difficulty of measuring the diameter of a hole having a slight taper is one of the problems which presents itself to the shop man. It came to the Autocar Co. in connection with roller bearings used on their trucks and was solved by the instrument shown, which is in reality a micrometer having a taper plug for its measuring point.

The plug *A* is carefully ground to the right size and diameter for a standard bearing, which when placed on



MICROMETER FOR TAPER HOLES

A with its shoulder in contact with the sleeve *B*, will show zero at the micrometer reading.

In practice the bearing is slipped over the plug *A* and the sleeve *B* adjusted until it contacts with the shoulder or end of the bearing. The graduation at *C* in connection with the comparatively slight taper of *A* enables extremely fine measurements to be taken, as the difference in diameter allowing endwise movement on the plug is multiplied many times by the graduations at *C*.

This has been found most satisfactory and a similar device can readily be utilized in other lines of work.

The Scramble for European Trade in Lumber Machinery

By JOHN B. WOODS
Formerly Captain of Engineers, Forestry Division, A. E. F.

One of the recent issues of a well-known lumber journal carries an interesting piece of news about the great exhibit of American lumber specimens which is planned for forty-nine Mediterranean cities. There will be samples of the products of thirty timber trees from the United States, with accompanying pamphlets in the proper languages to educate the inhabitants of those new market places in the matter of our lumber-exporting possibilities. All of which goes to strengthen the conviction that something is brewing over on the other side of the pond that is going to mean much to two important branches of American industry—the lumber manufacturers and the makers of machinery used by lumbermen.

SURVEYS OF the wood-products situation are timely and show certain changing conditions resulting from the delayed reconstruction programs. England is badly depleted in stores of standing timber, of which she had little enough before the war, though possibly she owns bigger stocks of lumber in France than at home. Certainly her wood products dumps across the channel contain large stores of war stuff which can be reworked for peace uses. France's standing timber has been cut and sold far beyond her reproductive deadline, but she owns great quantities of lumber and timbers which were placed in railroad yards and left there because of car shortages, and other stocks still at the small mills. This stuff will help her for a short time, but she must buy before long, in large quantities. Belgium appears to be a present and prospective customer with great possibilities of enlarging as her industrial strength returns.

FIG. 1. HAND-FEED PLANING AND JOINTING MACHINE

And because lumber is always somewhat a raw material, requiring more or less work before it can serve the purpose for which it was bought, these European countries must have woodworking machinery from some source to prepare their materials for use. Not only is there need to replace the worn-out equipment which the war has left with every nation, but because of labor shortages and the demands for immediate rebuilding in devastated areas, there is an additional call for machinery. The fact that parleys for a "peace at half the price" have not resulted as yet in anything absolutely binding, has held back France's 1919 reconstruction program, so when it really does start she will try to push it as fast as possible.

The most interesting phase of the question with us is, What nation will furnish the bulk of the needed machinery and lumber? We know that our country and Canada have been after the business for several months, and we know also that there are at least three other countries who are in first-class condition to take much of it away from us. I refer to the Scandinavian kingdoms and Finland. In the lumber field we find one of these countries experimenting with ocean-going lumber rafts, which promise to cut freights in half, and over here engineers are building demountable ships which can be constructed and loaded—so say the designers—as cheaply as the loading can be done for ships already afloat. So honors are even on the score of new schemes for advantages in freight and lading costs. And in the machinery field the problem may be simmered down to a matter of adaptation to European needs as against speed and operation refinements.

Stumpage in Europe is very high compared with our own. Every mill man over there buys his woodworking machinery with the idea of utilizing all the raw materials he gets at a minimum of waste. And in the Northern countries above mentioned, where lumbering has been almost a national industry for many generations, the utilization of waste has become a highly developed part of the business. It has been stated as a fact by one of the investigators sent over there by the Federal Trade Commission that they often realize bigger returns from their byproducts than from their standard-sized lumber. For this reason the European manufacturers of machinery have developed their products along the lines of low wastage and incidentally have followed as well the idea of low power consumption.

Judging from the types of equipment used in England and France during the war, neither of these countries has ever made any great effort to lead the world in the development of lumber-working machinery. Both nations have bought the bulk of their lumber and timber, and in England, particularly, logging and lumbering was somewhat out of the ordinary.

France builds very good band-sawing machines of low speed and limited production. But the woodworking-machinery field never has been startled by any revolutionary inventions from either France or England.

Development of Lumber-Sawing Machines

In our own case, one need but to scan the advertising pages of any lumber journal or better still, visit the plant of a representative lumber manufacturer to become convinced that we have made tremendous strides in the last decade, developing new types of machines so fast that it actually has been sane and economical to scrap machines of old design even though they were good for many years of service, and install new equipment in their places. Not only in the sawing of logs, but all along the line, through many devious by-product pathways, the machinery designer and the

inventive genius have kept ahead of the industry and brought forth new machines so fast that five years puts a type sadly out of date. Our watchword always has been speed, trees being plentiful and easy to obtain. In the small mills in this country we waste quantities of lumber for the sake of sawing logs quickly, a feature which did not appeal to the French when our mills were offered for sale by the Army after the armistice. But in our large band mills the wastage has been reduced to a reasonable percentage, considering the productive speed.

In the matter of handling logs during the sawing operation our builders have outstripped the world in making the mill man independent of human brawn. Then we have developed transfer systems and live rolls

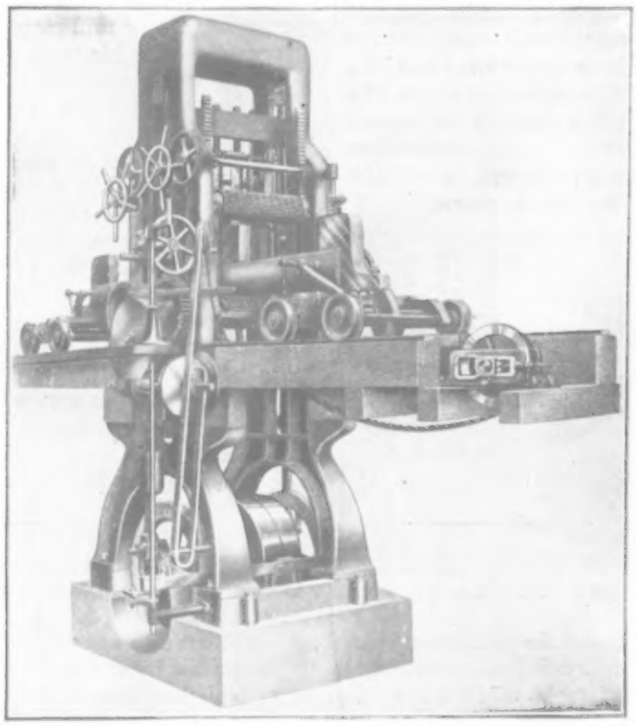


FIG. 2. LOG-SAWING MACHINE WITH ROLLER FEED

and chains for carrying lumber and timbers from saw to loading platform, with cutting-off and resawing machines en route so that a piece of wood can go from log pond to car and be operated upon from one to ten times without stopping on the way. In the planing and shaping field our machines have gained tremendously in speed of operation and low labor needs without sacrificing quality of the work. Two hundred and fifty lineal feet per minute is but ordinary for a flooring or surfacing machine, while in Europe one hundred feet per minute is awe-inspiring and automatic feeding devices are practically unknown. Byproducts equipment tends more and more toward automatic feed and operation and flawless production. Of course in all American designing the governing conditions are: Comparatively low-priced logs and lumber; costly and often unobtainable labor, to be replaced by automatic feed and handling; fairly plentiful and relatively cheap power, of which our machines require a great deal to do their work because of their speed. We buy a piece of equipment to do each operation and then we arrange our plant so that this machine is kept working at capacity load as much of the day as possible. And every other link in the chain of production is doing likewise.

Which of our conditions give us favorable consideration by the buyers over on the other side and which do the opposite? In one respect we are on a bad course at the start, for the item of cheap stumpage does not exist over there. Neither does cheap power, although that disadvantage is not so serious as might be expected, for in the coming rush to get work done the people of Europe are going to demand big things in the way of production, and will pay for the power as a matter of urgent need. The single-purpose machine will be handicapped when opposed by those of many capabilities, especially when offered to the small manufacturer, for he will cling to his traditions of universal machines and will be frightened both at the investment required for complete installations of single-purpose machines and at the scientific aspect of operation where several specialized steps are linked closely together. In the matter of building to minimize the drawback of scarce labor we have developed a field that Europe for the first time in centuries is entering. War losses and the unprecedented call for peacetime work has put the laboring man in the position where he can demand almost whatever he chooses. Even in the neutral countries of the other side, day labor jumped from about a dollar per diem to four dollars, with working hours shortened as well. So anything that cuts the labor cost will be favorably received by European buyers. And therein lies one of our real advantages, probably the greatest.

So far the discussion has dealt only with peoples outside the crowd of losers, but what about Germany and her potentialities as a manufacturer of the articles concerned? Probably more than any other country Germany has concerned herself with all phases of the lumbering industry. For two hundred years she has been producing forests as a part of the general scheme of things, the scattered states experimenting in forestry long before the recently disrupted empire was formed. And her woodworking industry was built up on a solid foundation, for Germany imported vast quantities of wood and bought most of this material in the rough. Logs and billets came in from Russia and Austria and the Balkan countries, to be worked up and made usable in the factories of the Fatherland.

GERMAN MACHINES OBSOLETE

As a result of the widespread interest in lumbering and woodworking several really great plants sprang up to supply these people with machinery and in the course of time these plants built enormous volumes for export trade as well. While their products are typically German in design and workmanship, they have not hesitated to borrow ideas from other countries when the borrowing was good. Their advertising methods have been methodical and painstaking just like so many other German developments of recent years. The machine for several purposes is particularly favored by the mill operators of that country, and so it is manufactured in many types.

Glancing through an old illustrated catalog of the plant of the Schmalz Family at Offenbach-on-the-Main, I find a hand-feed planing and jointing machine, Fig. 1, which also has molding apparatus and boring and mortising attachments. It is a very heavy cast-iron framed affair, as are most German machines. Then there is a band-saw with small carriage and special attachments for sawing deals and flitches as well as

logs. To go into the barrel field, a very important region for the European, I find a contrivance, Fig. 3, which purports to be a jointing, grooving and tongueing machine for sawed staves, with edging apparatus, automatic feed by endless chain and automatic adjustment of the cutters according to the width of each stave. Automatic feed and adjustment are beginning to take the place of hand feed in the German scheme of things mechanic. These illustrations are four years or more old, but they represent the last word in improvements before the war and therefore are the point

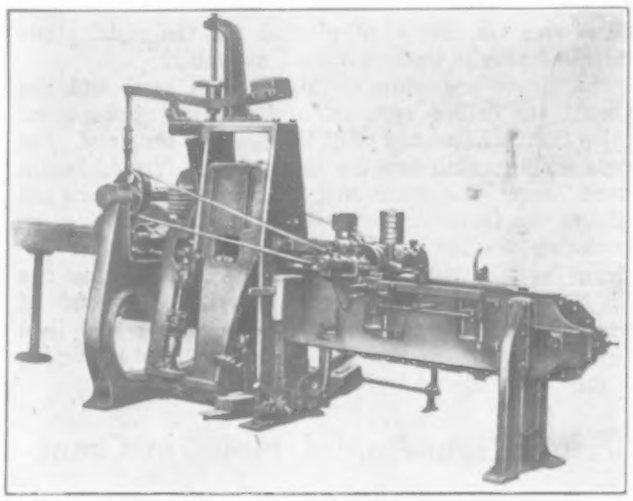


FIG. 3. MACHINE FOR JOINTING AND GROOVING BARREL STAVES

from which the new awakening will start. So the American points have been adopted to a certain extent by the Germans, who sent men to our shops to borrow ideas. But they never were able to assimilate our ideas of high speed plus perfect work; in their minds the two do not travel together.

Competition in the Future May Be Three-Cornered

It is but reasonable to suppose that by the time the penalities for the war have been assessed, Germany will have but one means of saving herself from the scrap heap, and that will be intensive manufacturing to a degree greater than she has ever practiced. There will be buyers from countries not combatant in the war just as in the olden days. And because her condition is so desperate, her manufacturers will work at greatest possible speed, taking advantages of their old developments and seizing all the new ideas that can be found useful.

So really the race for business may well become a triangular affair, with the Northern countries presenting certain strong features such as a thorough knowledge of the lumber field in particular and European commerce in general, with export associations to keep terms and prices stable, and machinery which has been proved by long use in the neighboring localities. Then there will be our erstwhile enemies with their facilities for great production and their grasping natures, reaching out after ideas—and orders—just as earnestly as they reached for the world a few months back. And in our own case we have the machines for high-production marks at low labor costs, which really should be the deciding argument in the majority of instances.

Steps in Making an Aluminum Moving Coil for an Ammeter

By K. H. Condit
Associate Editor, *American Machinist*

Most people who have had anything to do with automobiles or airplanes are quite apt to associate the Dixie magneto with the name Splitdorf Manufacturing Co., and let it go at that. The Newark, N. J., factory, however, turns out a few other ignition details in addition to magnetos and among them is a small station meter which is variously wound and used as an ammeter,

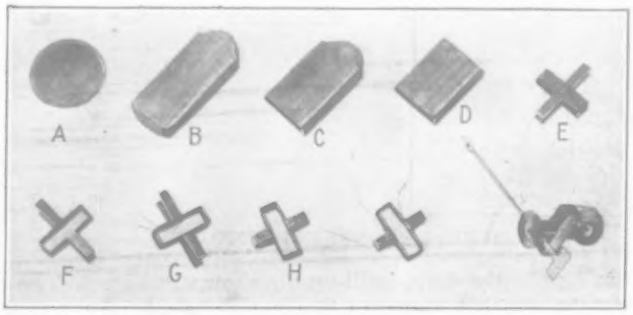


FIG. 1. PROGRESSIVE MANUFACTURE OF MOVING COIL

voltmeter or voltammeter for the instrument board of a car or motorcycle. The latter application is the more important because of the severe treatment anything connected with that instrument of torture (including the rider) receives. A delicate instrument would hardly last once around the block.

This discussion, however, has to do only with the moving coil of the Splitdorf meter—the business part of it. Fig. 1 illustrates the various stages in the transformation of an aluminum disk into the finished coil. Present production is hardly great enough to warrant automatic machinery so that various punching operations are performed on hand-operated arbor presses. The first transformation is the result of drawing the alumi-

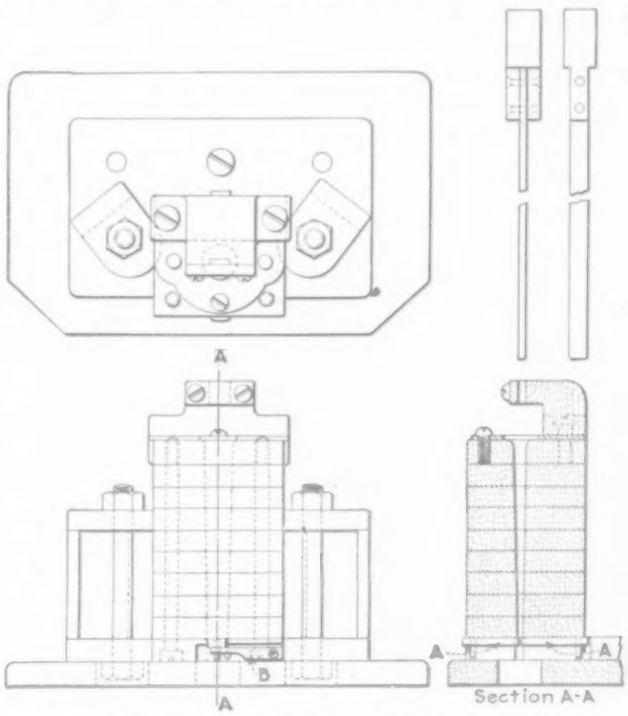


FIG. 2. BUILT-UP DEEP-DRAWING DIE

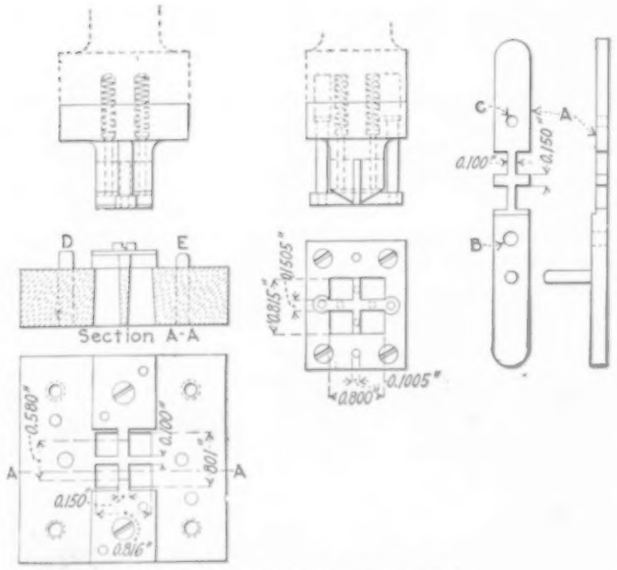


FIG. 3. BLANKING FIXTURE

num disk in the deep, built-up die shown in Fig. 2. The straight punch appears in the upper right-hand corner of the cut. The stripping fingers are shown at *A* and their operating springs at *B*. Vaseline is used as a lubricant and the job is done in a Greenerd arbor press with counterweighted arms. The condition of the subject before and after the operation will be seen at *A* and *B*, Fig. 1.

The blank now passes to a small arbor press where it is mounted on a horn and one end cut square with a shearing die *C*, Fig. 1. The blank is then removed and reversed and the other end similarly treated so that it appears as at *D*, Fig. 1. Incidentally, all of the operations except the deep-drawing are performed by girls. The corners of the rectangular blank are now removed in the blanking fixture of Fig. 3. The work is slipped on the horn *A* which is located on the die by the holes *B* and *C* which fit the pins *D* and *E* respectively. It will be noticed that the two pins differ in size to make the correct placing of the horn a foolproof affair. The burrs are next taken off by hand with a 6-in. fine pillar file, and *E*, Fig. 1, represents the progress of the frame up to this point.

The ends are bent up to give the form shown at *F* and a slip of shellacked tissue paper applied to form an insulating layer next to the aluminum. The bending

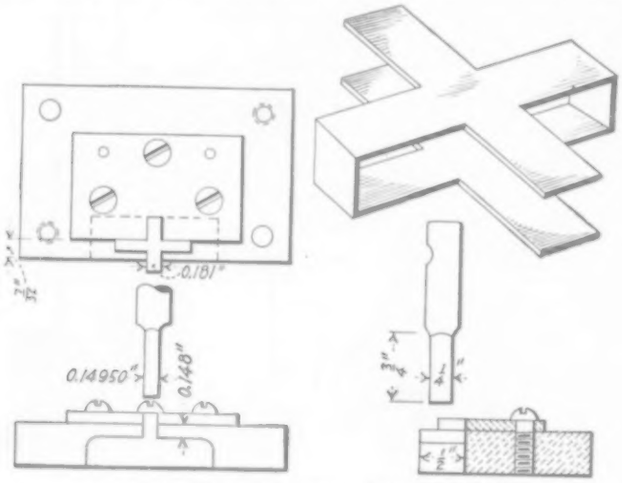


FIG. 4. DIE FOR BENDING UP ENDS

die for this job is shown in Fig. 4. The piece is mounted on the die, as illustrated, and the punch drives it through the opening. The operation must be repeated with the piece reversed to turn up the opposite legs.

The skeleton is next mounted in a simple winding machine and the proper numbers of turns of enameled wire, depending on the type of instrument for which the coil is intended, are wound on. The ends of the coil are secured by a turn round diagonally opposite legs as will be seen at *G*, Fig. 1. The coil is varnished and baked for three hours.

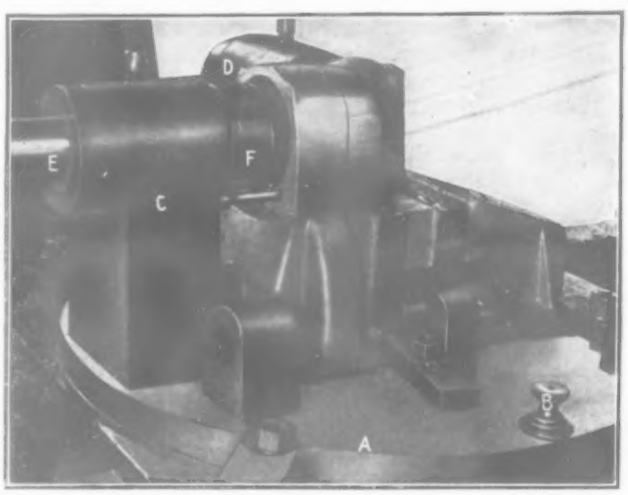
After being baked the coil returns to the arbor press and the open ends are bent over as shown at *H*. The folded-over tips are then pierced for the pivot studs and the frame is ready for final assembly.

The pivots are made of high-carbon steel and are forced into drilled recesses in the pivot studs, after which they are polished to fit the jewelled bearings. The studs are threaded and the inner end is formed into a round head. The studs are inserted from within the bend of the frame and carry an insulating bushing, an insulating washer and a spring-carrying washer between the aluminum frame and the lockout. On one side the aluminum pointer is also carried. The leads of the coil are soldered to the spring washer and then varnished and finally the phosphor-bronze torsion springs are soldered to their carrying washers.

Boring Right-Angled Holes in Crank-Case Cover

BY FRANK C. HUDSON

The crank-case cover used by the Autocar company, is of aluminum and has a number of surfaces to be machined. The boring fixture consists of the turntable *A* controled by the index pin *B* and the uprights *C* and



INDEXING FIXTURE FOR RIGHT-ANGLED HOLES

D. Both *C* and *D* carry bronze bushings for the boring bar *E*. In the position shown, the cutter head *F* is guided into the work by the upright *C*.

In the next operation, which is to bore a hole at right angles with this, the turntable *A* is turned 90 deg. so that the support *D* comes in line with the boring bar, and guides the bar, while boring the next hole. Heavy bronze bushings are used in both cases, and very satisfactory results secured.

A Practical Comparator for Screw Threads

By JAMES HARTNESS
President of Jones & Lamson Co.

The war focussed attention on the necessity for greater accuracy in screw threads, and closer measurements and tolerances were demanded and secured in many cases. Most of our measuring methods, however, give us little or no idea of the actual condition of the thread surfaces, which is a very important factor, not only in the first fitting of threaded parts, but in their wear and service.

THE problem of obtaining good thread fits involves more factors than we are apt to realize. How will the thread fit — not only the first time but the tenth or twentieth time it is screwed into the nut or hole (not when screwed in with the fingers but after it has been tightened with a wrench)? If the thread is not perfect —and we know it is not — where is the error and is it enough to prevent its being a sufficiently good fit in its mating hole? We can measure the pitch diameter, the lead, the major and minor diameters (as we now call the crest and root); but this means four gagings and four gages, and they do not tell how much one error will offset the other. They do not show the kind of surfaces which you are trying to screw together, or give even an inkling as to whether the slight inequalities will "iron out" or not, as to what will happen when they are screwed together —and not only the first time but the tenth.

FIG. 1. THE APPARATUS AT WORK

These are some of the considerations which led to the development of the Hartness Screw-Thread Comparator which affords a means of measuring screws with great accuracy in a thoroughly practical manner, in every day shop work instead of in a laboratory. This however must not be taken as any criticism or lack of appreciation of the work done by others along this line, as I regret the inability to credit each with his contribution to the work which has been done. The projection lantern has long been used for the inspection of screw threads of various kinds but its use has generally been limited to such fine work as gages or precision screw inspection. The machine shown herewith makes it possible to see instantly the resultant effect of all the elements which affect the dependableness of the screw-thread fit. It can also be used quite rapidly and in almost any part of the shop which may seem desirable. In measuring threads with gages of various kinds we apply but a gentle pressure to avoid wear of the gage. This is very unlike the assembling of the threaded parts which smooths down the rough parts, stretches or compresses as the case may be, and leaves it a very different screw than when it was passed by the gage now in use. This is particularly important since threads cannot be produced commercially with anything like the precision obtainable with cylindrical, flat or spherical surfaces. This fact emphasizes the necessity of a gaging system which shows clearly the real characteristics of the thread.

What the screw maker and the user really want to know is whether the screw will have a sufficient bearing in its mating part, a bearing that can be depended upon

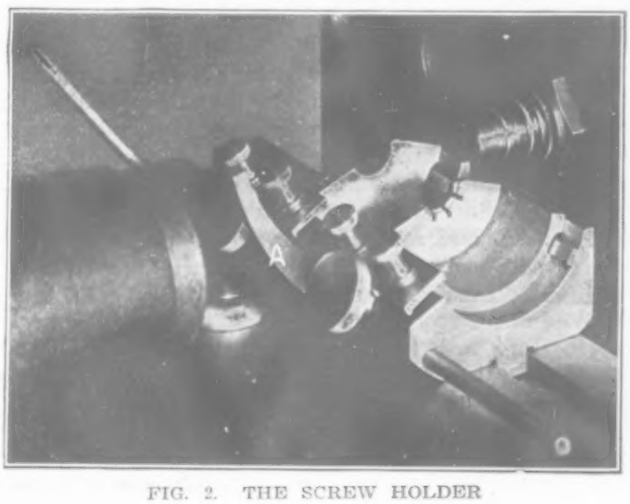


FIG. 2. THE SCREW HOLDER

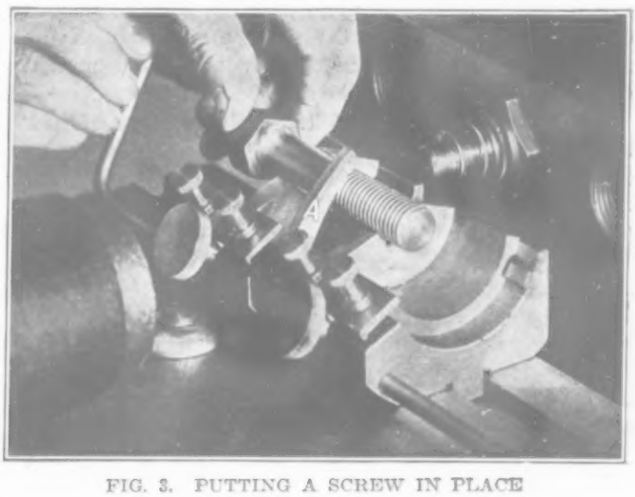


FIG. 3. PUTTING A SCREW IN PLACE

for strength and service. The feel gage does not tell this as the bearing may be on some non-essential part and thus deceive as to the real size of the flanks which take the stress.

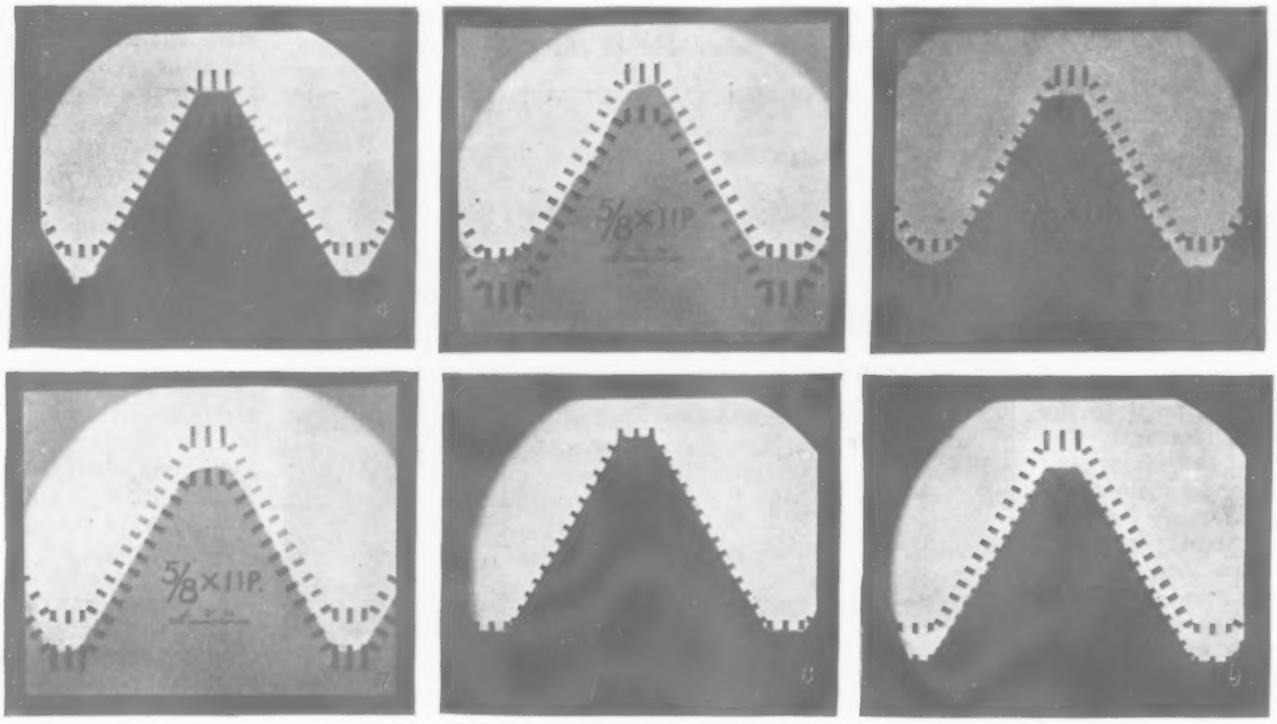
A great majority of machine failures are due to misfitting screws and in all highly stressed machines, such as the gasoline engine and the airplane, various locking devices are used wherever possible. In other places tightly fitting screws are used and here the new method of inspection is of particular value. Then there are adjusting screws of various kinds, screws which are subjected to hammer-blow shocks which cause the metal to flow and change its relation to the mating piece.

This flow of metal and the smoothing down of imperfections has long been recognized by careful mechanics—among them the veteran automobile builder, Henry M. Leland, who long ago took advantage of it to secure close fitting screws in vital parts of his motor. Hardened plugs and rings, which were virtually gages, were forced into the holes and over the bolts to smooth down any inequalities of the surface and burnish the mating parts so that repeated screwing in and out did not destroy the quality of the fit.

The illustrations which follow tell the story of how the projection lantern eliminates the uncertainty as to the fit and the wearing qualities of the screw, how it supplants the blind "feel" and does away with all wear on gages.

The apparatus is shown at work in Fig. 1. The lantern is mounted on a substantial pedestal which also carries the cradle for the screw being measured and the projecting lens. The screen or "gage" is mounted on the iron-pipe framework shown and this also affords support for the boxes of screws being gaged. As can be seen the room is not darkened except to keep out the glare of sunlight. The screen or gage is drawn up for each thread to be tested and is 200 times full size. The thread is outlined by the black dots, the distance between the two outlines being the tolerance, which is of course also multiplied 200 times. This means that a variation of 0.001 in. becomes 0.200 or $\frac{1}{5}$ in. on the screen and that very small tolerances can be easily seen and read.

The cradle which holds the screw is shown in Fig. 2. The screw rests in the semi-cylindrical pieces which can be clamped in the proper position to throw the projection in the right place. On most work only one of the pieces is threaded but should the screws be long, or not true with the body, it is sometimes advisable to use threads in both pieces. The distance of the threaded piece from the center of the projection lens shows the variation in lead in that distance. The screw is forced down by the finger *A* to insure its being properly seated in the cradle. The two screws provide easy and rapid adjustment for the lens. In Fig. 3 the screw is just being put in place.



FIGS. 4 TO 9. HOW THE DIFFERENT THREADS LOOK ON THE SCREEN

Adjusting the Lantern

The next step is to get the lantern adjusted to give a sharp image on the screen, the first move being to swing the lantern so as to throw the light parallel with the helix of the thread. This is easily done and remains set for all screws of the same diameter and pitch.

The remaining illustrations show projections of $\frac{5}{8}$- and $\frac{3}{4}$-in. standard screws. The first, Fig. 4, shows a gage or standard plug which comes very close to the high limit. The form, however, is very good with the exception of the root at the left where the tool evidently dug in. Figs. 5 to 8 show screw threads and give some idea of the irregularities of surface and lead variations. Fig. 5 shows good flanks except for the low spot at the left, but the core seems large. This is probably due to oil in the threads which can easily be determined by the inspector.

In Fig. 6 we have a variation in lead which brings the left side into the high limit of the chart. Whether this is passed or not depends upon the inspector's instructions. It might answer for some work but in any case we know exactly what the defect is at a single test and without the uncertainty of the "feel" of three or four different gages. Fig. 7 shows a screw which borders on the minimum but which has good surfaces and is true to form so that it would probably give better service than many which might feel much better to the inspector using the regular ring gage.

Large and small screws and plugs are shown in Figs. 8 and 9. These leave no doubt as to just what ails them both, and knowing exactly the condition of each screw thread we can determine much more intelligently whether or not it will answer our purposes.

Usual Methods of Screw-Thread Measurement of Little Value

It is clear that the usual methods of screw-thread measurement do not reveal the essential characteristics of the thread, because they do not show the extent of thread surface that will be in contact with the mating part, which is the measure of its holding power and its wearing qualities. The profiles show that the so-called cutting process is in reality more of a crushing or extruding of the metal and that the threads are not true to form. This in reality merely prepares the screw for its real finishing process which is the squeezing of the thread into conformation with its mate, the nut or threaded hole.

We know that by taking special care we can produce nicely formed screws, but a magnification of even these frequently reveals undesirable irregularities. But there are few cases where the manufacturing conditions permit this special care and we are forced to produce screws which this magnification shows to be full of irregularities that make the usual gaging methods of little value.

Summary

This system shows the resultant effect of errors in lead, form of thread, smoothness of surface and diameter. It includes the tolerance measurement that insures interchangeability and prevents the acceptance of undersized and undependable screws. A glance at the shadow shows how much metal there is to flow and whether or not this is too much. It reveals actual conditions as no system of feel gaging can. It facilitates manufacture by showing all the factors which enter into a good thread fit. It gives the inspector the opportunity of measuring the screw at the mean depth of the rough surface instead of at the crests.

The best method of introducing such a system will be to let it find its place in any shop using regular gages. This will not disturb the regular flow of work and will be more satisfactory to all concerned. It is necessarily a shocking revealer of unsuspected conditions but it becomes a final arbiter of all questions which have hitherto vexed the manufacturer and the buyer's inspector. It eliminates all unknown quantities and leaves no room for difference of opinion as to the actual diameter, shape, lead and condition of the threads under inspection. Instead of sending sets of costly gages to measure screws the buyer can send a chart or "paper gage," which the inspector uses as his guide in passing or rejecting the work.

We Are for the Working Man

By Charles Eldridge

Your editorial under the above heading on page 770 is timely and it contains much food for thought. That the *American Machinist* has always advocated reasonable hours and better working conditions is known for a fact by its army of readers, and I know what I am writing about because I have been a steady reader of the *American Machinist* for over a quarter of a century. Many changes for the good of the machinist have been brought about in that time and the publicity given to the improvement of working conditions, means for safeguarding the machinist, etc., that you have published, have done much toward bringing about present-day satisfactory conditions for the working man. Any person who states that the *American Machinist* is not for the working man is either grossly misinformed or an out-and-out trouble breeder.

Our present-day labor unrest is not caused by the rank and file of organized labor. It is the trouble continually kept stirred up by the agitators who must continually "agitate" to hold their jobs. We have horseshoers who never worked in a rolling mill trying to run the steel industry, men who never saw the inside of a machine shop (in overalls) attempting to direct the machine industry, men who never saw the inside of a coal mine attempting to say what the coal miners want, a horde of parasites who are as ignorant of typographical matters as a babe unborn bringing havoc to the printing industry in New York, and so on, *ad infinitum*.

Organized labor generally has had public opinion on its side. The rank and file of trade unionists are sober, intelligent citizens, but they have allowed themselves to be run away with. All these harmful "isms" are the result of diseased brains. The radicals seem to have control and to have overridden the better judgment of the conservative element. Organized labor does not advocate any more—it is defiant—it demands with a what-are-you-going-to-do-about-it air. The dream of less work per day to make more jobs for trade unionists has proved to be a fallacy. Production at the present time is way below what it should be. Cannot the working man be made to see that curtailed production means higher prices for all? Cannot he see that for every raise in pay he gets, his living costs mount upward as increased costs are passed around the circle again until they reach him?

The idea that labor produces everything is all wrong. It is the brains behind labor that make production possible. Labor is but the instrument whereby production is carried out. Yet thousands of trade unionists in this country dream of the day when they can force a soviet form of government on this country. God help the United States if this ever happens! The scenes of bloody Russia will be brought home to us as actualities.

"We are three million strong," cries organized labor. Yes, this is true, but consider for a moment the thirty or more million workers who are not organized. They are the sober, industrious, so-called middle class. And they are growing tired of acting as a buffer between labor and capital. If organized labor intends to purge itself of the parasites who seek to run it into disfavor it had better not delay in cleaning house. As the matter stands today, organized labor in general is riding for a serious fall. Can it see the handwriting on the wall in time?

Altruism or Advertising?

IN THE issue of October 30, we made an appeal for measures to hold our foreign machinery markets. That effort was aimed at the country at large through the Director of Sales of the War Department.

We have just had the pleasure of reporting the closure of a twenty-five million dollar contract for machine tools with the French Reconstruction Service. This is an excellent start and should point the way for similar sales of other surplus equipment which would be useful for reconstruction work. There is plenty of it.

In our opinion this is the best possible use for such material. It is not only a part payment of our heavy debt to the Allies but also superlatively good advertising.

The somewhat similar arrangement with the Societe le Construction Metallique of Belgium has encountered an obstacle which was to be expected. Like any other accumulation of surplus equipment, that of the War Department lacks many of the items most needed by the purchasers.

To meet this situation, Col. Alfred La Mar, the Assistant Director of Sales in direct control of machine tool sales, has put it up to the machine tool builders of the country to supply the missing items. His letter appears in full on the opposite page.

There could not be a much worse time to make such a request. Most machine tool makers are tied up with orders for six months or a year. Raw materials are high and scarce. Labor costs are steadily increasing.

But present difficulties must not be permitted to drive out all thoughts of the future. The time will soon come when war-time shortages will be made up and competition for foreign business will be keen. Rates of exchange will have returned to normal figures and freights will be more reasonable.

When that time comes repeat orders will be far easier to secure than new business. The manufacturer with a shop full of German tools will need a lot of showing before he puts in American machines and goes to the trouble of teaching his men to use them.

Isn't this proposition worth some hard thinking and careful figuring? When you have shaved the last possible cent from your quotation, stop a moment and place yourself in the position of the Belgian manufacturer who is going to buy your product.

The Germans stole all his machinery and have given very little of it back. His factory buildings were stripped. Many of his best workmen were killed in the trenches. His taxes were and are heavy. And worst of all, his money has depreciated almost fifty per cent.

Are your figures still correct? Remember that the Belgians are making a wonderful recovery. Most of the important railways in the devastated region have been rebuilt and trains are running. The coal mines have been reopened and are running very close to normal output.

All things considered, Belgium looks like a valuable customer to have on the books. If it is necessary to cut out all profit on the order, charge it to altruism or charge it to advertising, but don't lose the order.

WAR DEPARTMENT

PURCHASE, STORAGE, AND TRAFFIC DIVISION
OFFICE OF THE DIRECTOR OF SALES
WASHINGTON

Address reply to Director of Sales, Munitions Building.

AL/mch

December 10, 1919.

Gentlemen:

You are informed that the Societe le Construction Metallique of Brussels, Belgium, a coöperative society composed of approximately 500 manufacturers, placed an order with the War Department, Director of Sales, for machine-tool equipment, list of which is attached, and which has so far not been discovered among the War Department surplus machine tools.

Inasmuch as it is probable this equipment will not be found available for sale among the War Department surplus and in order to relieve the War Department from any further responsibility in this matter, it has been decided to assist the Construction Metallique in transferring the order to American manufacturers or dealers, if it so desires, and providing satisfactory quotations can be secured.

It is requested that quotations be made for supplying the equipment listed, or its equivalent, referring to the identification numbers given and making your quotations, in each instance, shipside New York, and also, if possible, c.i.f. Antwerp.

The sale price agreed upon by the War Department and the Construction Metallique was the c.i.f. Antwerp price of August, 1914, plus 55 per cent.

It is probably needless to invite your attention to the fact that the European rate of exchange is very much against export sales; that the Construction Metallique by paying cash is paying a very much higher price on account of the exchange rate than they would be required to pay for machinery manufactured in Germany or other European countries. The Construction Metallique prefers to buy American made equipment and it is, therefore, recommended that you make your quotations at the lowest possible figure.

It is highly desirable from the American manufacturer's standpoint to have American machinery installed in Belgium. This has been recognized, I believe, by the National Machine Tool Manufacturers' Association and its members have been bringing as much pressure as possible on their congressional representatives to promote sales of War Department surplus machinery abroad. This is an opportunity for American manufacturers to put their evident desires into practice.

Your reply will be awaited with considerable interest.

All quotations should be addressed to Lieutenant Marc Jeanjean, Director General of Construction Metallique, Room 2526 Munitions Building, Washington, D. C., and should be marked "Personal." Lieutenant Jeanjean will carry on all further negotiations in this matter. You are urged to give this immediate attention, as Lieutenant Jeanjean expects to return to Belgium within a very short time.

By authority of the Director of Sales:

Very truly yours,

(Signed) A. LA MAR,
Assistant Director of Sales.

List of Tools Wanted by Construction Metallique, Belgium

VERTICAL BORING MACHINES

No.	Size	Attachments	Maker	Customer's Ident. No.
1	36 in.	1 side hd	Bullard only (motor dr.)	659-L-8
2	36 in.	With turret toolpost	Gisholt or Colburn	681-L-38-39
1	42 in.	With 2 hds.	Gisholt, Colburn or Bullard	616-L-2
3	42 in.	Swing, with 2 swivel hds.	Gisholt, Colburn or Bullard	509-F-36
1	60 in.	Swing, with 2 swivel hds.	Gisholt, Colburn or other	509-F-39
2	30 in.	Swing with 1 turret hd.	Gisholt, Colburn or Bullard	509-F-41-42
2	24 in.	Swing with 1 turret hd.	Gisholt, Colburn or Bullard	509-F-43-64
1	42 in.	Two heads (with turret)	Gisholt, Colburn or Bullard	509-F-95
1	36 in.	Swing	Bullard, Gisholt or similar	215-B-7
1	36 in.	With turret hd. and 1 side	Bullard (cone or S.P.D.)	320-C-5
1	30 in.	Swing	Gisholt, Colburn, King or similar (S.P.)	304-C-23
1	84 in.	With 2 swivel hds., on crossrail	Gisholt, Colburn or other	320-C-6
1	36 in.	Swing with 1 turret hd.	Gisholt, Colburn or similar (cone)	207-B-7
1	24 in.	Table with turret hd., set tool-holders for turret	Bullard New Era Type, Gisholt or Colburn	660-L-9
1	48 in.	With 2 swivel hds. or crossrail	Colburn, King or Gisholt	406-D-4
1	36 in.	With 1 turret head	Colburn, King or Gisholt	406-D-5
1	36 in.	With 1 turret head	Gisholt or Colburn	502-F-25
4	No. 30	1 turret head, 30-in. swing	Colburn or Gisholt	370-C-23-24-25-26
2	4 ft	Vertical	Niles-Bement-Pond or Universal Boring Machine	208-B-83
1	30 in.	Swing	Bullard or Gisholt	848-V-5
1	42 in.	Car wheel	Niles-Bement-Pond	715-M-51
2	36 in.	Boring and turning turret	Bullard or Gisholt	840-V-4
1	42 in.	1 turret and 1 swivel	Gisholt or Colburn (S.P.)	659-L-1
1	42 in.	2 swivel		366-C-6
2	38 in.	Plain and 1 turret	Bullard or similar	366-C-7-8
1	36 in.	Swing with 1 turret —	Gisholt or Colburn	501-F-5
5	36 in.	With turret to toolpost	Bullard, King or Gisholt (motor)	715-M-13-14-15-16-17
2	30 in.	With turret to tool post	Bullard, King or Gisholt (motor)	715-M-18-19
2	48 in.	2 Swiveling	Colburn (motor)	715-M-20-20
1	42 in.	1 Swivel and 1 turret	Gisholt, Colburn or other	801-V-7
1	20 in.	1 Swivel and 1 turret	Gisholt, Colburn or other	801-V-8
1	30 in.	1 Turret	Niles-Bement-Pond or Gisholt	217-B-10
1	42 in.	2 Plain swiveling	Niles-Bement-Pond or Gisholt	217-B-11
1	30 in.	Turret toolpost	Colburn, Gisholt or similar	281-B-6
1	No. 31	Bed giving distance between spindles and outer support 7 ft. (latest model)	Lucas, Universal boring or similar	219-B-11

HORIZONTAL BORING MACHINES

1	No. 31	Table, horizontal boring, milling and drilling	Lucas	223-B-27
1	No. 31	Boring, milling and drilling with special long bed, 72 or 84 in. max. distance faceplate to outer support and special wide platen 34 x 48 in.	Lucas	659-L-9
1	No. 32	Universal boring, drilling and milling machines	Lucas or Universal Milling Mach. Co	684-L-9
1	4 in.	For boring cylinders with 4 spindles	Moline (Hole Hog)	208-B-82
1	No. 32		Lucas or similar	221-B-20
1	6 in.	With 3 to 3.5 meters lateral movement, but with outer support without baseplate	Niles-Bement-Pond, (Detrick & Harvey preferred)	616-1-5
1	10 in.	Bar feed about 20 in. smallest size	Universal Boring Machine Co., or similar	707-M-3
1	No. 31		Lucas or Universal Boring Co., No. 3½ or similar	509-F-126
1	No. 32	With all accessories	Lucas or similar	717-M-2
1	Same size		Fosdick, Lucas or Universal boring machine	429-D-12
1	5 in.	Horizontal and column complete with outer support, motor d. c. 220 v.	Detrick & Harvey or similar (motor)	715-M-49
1	No. 31	Motor d.c., 220 v.	Lucas or similar (motor)	715-M-50
1	No. 31	Horizontal boring, milling and drilling	Universal Boring Machine Co. or similar	403-D-4

No.	Size	Attachments	Maker	Customer's Ident. No.
1	5 in.	Motor d.c. 220 v.	Newton or similar (motor)	654-L
1	No. 31	Horizontal boring and drilling mill	Univeral Boring Machine Co. or similar	801-V-3
2	30 in.	Plain boring bar		366-C-3-4
1	4 in.	1 boring head and 2 facing heads	Beeman & Smith or similar (cone)	639-L-1
1	No. 31	Complete with rotary table	Lucas	651-V-4
2	2 spdls	For boring motor cylinders and crank cases	Any make (S.P.D.)	274-B-29-30
1	No. 1	With 2½ in. spindle or other of same dimensions	Cleveland (S.P.D.)	617-L-6
1	3 in.	3 in. spindle	Lucas No. 31 or Universal boring (monopulley)	617-L-7
2	No. 31		Lucas or similar	211-B-28-29
1	5½ in.	Runaway up to 20 transportable table	Detrick & Harvey or Newton or Pawling-Harnishfeger	304-C-68
1	No. 31		Lucas	502-F-31
1	6 in.	With 10-ft. travel col. on base, 6 ft.; travel of saddle on col. feed, 5½ in. Base plate must be furnished with machine, but blueprint of same should be sent so that same can be made in the country	Harnishfeger or Detrick & Harvey or similar	319-C-22
1	3½ in.	With 10 ft. travel col. on base, 6 ft.; travel of saddle on col. feed, 5½ in. Baseplate must be furnished with machine, but blueprint of same should be sent so that same can be made in the country	Landis Tool Co. or Harnishfeger or Detrick & Harvey	319-C-23
3	No. 31	Horizontal	Lucas or Universal Boring corresponding size	208-B-113-114-115

GEAR CUTTING MACHINES

Fellows Automatic Spur Gear Shapers for module pitch gears

Customer's Ident. No.		
(274 B 27)	1	No. 61, belt drive, full equipment with countershaft. Five cutters module 44 mm., 20 deg. pressure angle. Boxed for foreign shipment
(271 B 1)	1	No. 64, belt drive, full equipment with countershaft; three cutters module 4 mm. 20 deg. pressure angle. Boxed for foreign shipment
(104 A 177)	1	No. 6, belt drive, full equipment with countershaft. Boxed for foreign shipment
(208 B 75) 76 77	3	No. 6, belt drive, full equipment with countershaft. Boxed for foreign shipment

Brown & Sharpe Automatic Gear Cutting Machines for Module Pitch Gears

(848 V 7)	1	No. 4, page 173 catalog No. 136. Complete equipment Metric involute H.S.S. cutters, Module 1½ mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 2 mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 2½ mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 3 mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 3½ mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 4 mm. 20 to 120 teeth Metric involute H.S.S. cutters, Module 4½ mm. 15 to 100 teeth Metric involute H.S.S. cutters, Module 5 mm. 15 to 100 teeth Metric involute H.S.S. cutters, Module 5½ mm. 15 to 100 teeth Metric involute H.S.S. cutters, Module 6 mm. 15 to 100 teeth Hole in cutters to be in metric. Boxed for foreign shipment.
(840 V 8)	1	No. 4, page 172, catalog No. 136. Complete equipment. Boxed for foreign shipment
(208 B 110)	1	No. 3, page 168, catalog No. 136. For gears 26 in. in. diam., 8 in. face. Complete equipment. Boxed for foreign shipment
(208 B 72)	1	No. 13, page 178, catalog No. 136. For gears 18 in. in diam., 4 in. face. Complete equipment. Boxed for foreign shipment
(208 B 73)	1	No. 3, page, 168, catalog No. 136. For gears 26 in. in diam., 8 in. face. Complete equipment. Boxed for foreign shipment
(840 V 7)	1	No. 13, page 178, catalog No. 136. For gears 18 in. in diam., 4 in. face. Complete equipment. Boxed for foreign shipment
(104 A 40) 41	2	No. 3, page 168, catalog No. 136. For gears 26 in. in diam., 8 in. face. Complete equipment. Boxed for foreign shipment
(104 A 178) 179	2	No. 3, page 168, catalog No. 136. For gears 26 in. in diam., 8 in. face. Complete equipment. Boxed for foreign shipment
(632 L 4)	1	No. 3, page 168, catalog No. 136. For gears 26 in. in diam., 8 in. face. Complete equipment. Boxed for foreign shipment
(208 B 111) 112	2	No. 4, page 172, catalog No. 136. Complete equipment. Boxed for foreign shipment

Gould & Eberhardt Gear Cutting Machines

(309 C 39) 40 41 42 43 44	6	48 x 12 in. Vertical gear cutting machine for module pitch gears. Bulletin No. 2. Complete equipment including oil pump and pan. Boxed for foreign shipment
(329 C 44)	1	48 x 12 in. Vertical gear cutting machine for module pitch gears, Bulletin No. 2. Complete equipment inculding oil pump and pan (Customer calls for machine that will cut spur and helical gears but we do not know of such a machine that will handle work over 36 in. in diam.) Boxed for foreign shipment
(223 B 26)	1	72 x 10 in. light type automatic rack cutting machine for module pitch. Belt drive. Bulletin No. 17. Complete equipment including oil pump and pan. Boxed for foreign shipment
(281 B 11)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. Boxed for foreign shipment
(219 B 14)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. One set of H.S.S. Hobs, right and left hand Module 3½ mm. One set of H.S.S. Hobs, right and left hand Module 4 mm. One set of H.S.S. Hobs, right and left hand Module 4½ mm. One set of H.S.S. Hobs, right and left hand Module 5 mm. Boxed for foreign shipment
(840 V 9)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears, belt drive. Bulletin No. 6. Complete equipment. Boxed for foreign shipment
(223 B 7)	1	24 x 8 in. Automatic gear cutting machine for module pitch gears. Belt drive. Bulletin No. 15. Complete equipment including oil pump and pan. Boxed for foreign shipment
(429 D 4)	1	60 x 16 in. Vertical gear cutting machine for module pitch gears, belt drive. Bulletin No. 3. Complete equipment including oil pump and pan. Boxed for foreign shipment
(283 B 2)	1	Automatic gear cutting machine 24x8 in. for module pitch gears. Belt drive. Bulletin No. 15. For spur and bevel gears. Complete equipment including oil pump and pan. Boxed for foreign shipment
(274 B 39)	1	Automatic 24 x 8 in. gear cutting machine for module pitch gears. Belt drive. Bulletin No. 15. For spur and bevel gears. Complete equipment including oil pump and pan. Boxed for foreign shipment
(369 C 1)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. Boxed for foreign shipment
(274 B 36)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. 4 hobs H.S.S. for helical gears, 20 in. diam. Module 4 mm. 20 deg. pres. angle 4 hobs H.S.S. for helical gears, 20 in. diam. Module 5 mm. 20 deg. pres. angle Boxed for foreign shipment. Brown & Sharpe No. 1 bevel gear testing machine, catalog No. 136, page 184
(304 C 39)	1	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. Boxed for foreign shipment
(617 L 15) 16	2	36 x 14 in. Automatic gear hobbing machine for module pitch gears. Belt drive. Bulletin No. 6. Complete equipment. Boxed for foreign shipment 2 H.S.S. hobs for gears 36 in. diam. Module 8 mm.

Gleason Bevel Gear Generators for Module Pitch Gears

(104 A 51) 52	2	6 in. page 21, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment
(304 C 60)	1	18 in. page 24, 1917 catalog. Belt drive. Complete equipment. Generator tool grinder, page 33—1917 catalog for grinding cutter tools used on above machine. Boxed for foreign shipment
(104 A 47) 48	2	Spiral bevel, page 38, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment
(304 C 90)	1	54 in. Double, page 38, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment
(208 B 79)	1	18 in., page 23, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment
(208 B 80)	1	6 in., page 21, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment
(208 B 81)	1	Spiral type 15 in. diam., page 4, 1917 catalog. Belt drive. Complete equipment. Boxed for foreign shipment

Barber-Colman Gear Hobbing Machines for Module Pitch Gears

(211 B 19)	1	No. 12. Belt drive. Complet equipment. Boxed for foreign shipment
(208 B 78)	1	No. 12. Belt drive. Complete equipment. Boxed for foreign shipment
(104 A 180) 181	2	No. 12. Belt drive. Complete equipment. Boxed for foreign shipment
(455 D 21)	1	No. 12. Belt drive. Complete equipment. Boxed for foreign shipment

The Adams Company

(659 L 2)	1	Farwell No. 1 Gear Hobbing Machine for module pitch gears, page 17, catalog No. 808. Complet eequipment with set of 51 extra change gears. Boxed for foreign shipment

The Bilgrim Machine Works

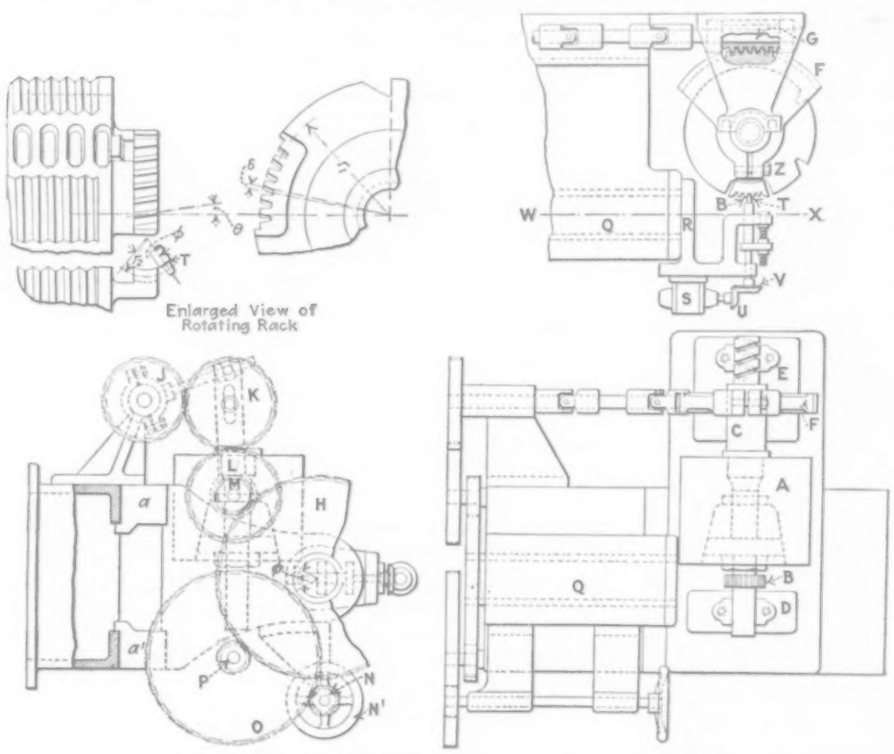
(223 B 6)	1	Bilgrim 16 in. bevel gear generator for module pitch gears Complete equipment. Boxed for foreign shipment (Customer called for a 21 in. machine but nothing is known of a machine of over 16 in. capacity.)

(This list is the only one available as we go to press. We hope to publish a revised list at an early date.—ED.)

Cutting the Rotating Rack For a Breech Block

By L. E. Olsen

During the period in which the writer was employed designing tools for gun work, numerous odd problems were experienced which were quite different from those encountered in the average manufacturing establishment. One of the most interesting of these is probably a milling operation for the rotating rack on the breech block for a 12-in. gun, model of 1895, MI Stockett mechanism.



LAY-OUT OF ROTATING-RACK CUTTING MACHINE

The idea of performing this operation, which will be described later, originated in the mind of Hugh Smith, assistant general superintendent of the Watervliet Arsenal, who was then foreman of the division in which this work was done. The machine first used was of a temporary character but embodied all the principles of the present machine, which has been greatly improved.

The rotating rack is a system of worm-gear teeth, inclined at 18 deg.; cut on a rack, part of which is longitudinal, and part circumferential or fan shaped, projecting from the rear of the breech block. The function of this member of the mechanism is to turn the block on its axis, causing it to be in locked or unlocked position with the thread sectors of the screwbox in the gun. When the block thus rotates it has in addition to its circular motion a movement along its axis; that is, a helical movement due to and governed by the threads upon which it turns.

The pinion which engages the rotating rack is called the compound gear. It is journaled in the breech plate and turns on a fixed axis. The teeth in this member are semi-spur and semi-worm. The latter teeth are those which engage in the rotating rack. Due to the helical movement of the block, the teeth in the rack must be cut along the path of a helix, parallel to the threads on the breech block and accurately located with them. The cutting of these teeth is one of the last operations on the breech block, and with the aid of the following drawing the writer will attempt to explain how this peculiarly curved tooth is generated.

Let *A* represent the breech block, and *B* the rotating rack. The block is mounted on arbor *C*, which is supported by the standards *D* and *E*. On one end of the arbor is a groove cut at the same lead as that of the threads on the block. *F* is a segment of a spiral gear which is clamped on the arbor with the screw *Z*, and driven by the worm *G*. This worm is in turn connected to the main gear *H* through the gear train *J-K-L-M*.

The handwheel *N'* is also connected with the main gear *H* through the gears *N-O-P*. On one end of the sleeve *Q*, the main gear *H* is keyed, and on the other end of this sleeve is fastened the bracket *R*, which carries the milling head. On the top of this bracket a motor *S* is mounted which drives the cutter *T*, through the miter gears *U* and *V*. The spindle for the cutter has fine vertical adjustment so that the sweep from the center line *WX* is easily adjusted to suit the roughing and finishing cuts. Thus when the handwheel *N* is turned three movements take place simultaneously. The

cutter T swings along the arc ϕ due to the movement of sleeve Q. The breech block turns through the action of gear segment F, and the arbor C advances along its axis due to the helical groove E. Thus, the actual working movements of the block, when assembled with the mechanism in the gun are precisely reproduced on this machine. The first tooth cut is located by means of templets, and the other teeth are spaced from an index plate, secured to the face of the breech block.

The idler gear K is introduced when reversing the helix from right to left hand. In some cases it is necessary to change the center distance between the axis of the block and the axis WX of the sleeve Q from which the cutter T sweeps. This is accomplished by substituting other parallels in place of a and a'. When changing the helix angle θ other gears are introduced into the train $MLKJ$, thereby producing the required ratio which may be resolved into the equation

$$\frac{(2r_1\,\pi)\,\frac{\delta^\circ}{360^\circ}}{(2r_2\,\pi)\,\frac{\phi^\circ}{360^\circ}} = \tan\theta \text{ or } \frac{r_1\,\delta}{r_2\,\phi} = \tan\theta$$

Locating Knocks in Motors

By D. C. Cook

While searching through some back numbers of the *American Machinist* for a reference, I came across an article under the above caption on page 107, Vol. 50. I shall not attempt to comment on the physical or psychological electro-mechanical possibilities of this apparatus, but the listening device described below, however, will work.

Referring to the accompanying drawing, the device, which is made from any close-grain hardwood, consists of an ear-piece, the details of which are a bell A and a diaphragm B. To the earpiece is fixed a rod C of any convenient length, the end of which is tipped with a cone-shaped metal point D.

A LISTENING DEVICE

This listening device has been used for locating knocks in motors, gas engines, machine tools and tremors in buildings caused by machine-tool vibrations, and has stood the test of time.

A Question of Etymology

By Harry Senior

I desire to take issue with the statement of C. H. Norton on page 795 of *American Machinist* that "no American who understands the English language will permit himself to call a grinding machine a 'grinder.'"

I do not know behind just what limitations Mr. Norton intrenches himself when he says, "'understands' the English language"; quite possibly he could prove that but few—perhaps none—understand it, but I will venture to say that I know, personally, some hundreds of good intelligent citizens of the United States, who speak of a grinding machine as a "grinder" and who know instantly what is meant when they are spoken to of "grinders."

These same men, machinists and toolmakers of the old school, than whom no more capable, intelligent and conscientious class of people exists, also speak without shame of a planing machine as a "planer," a milling machine as a "miller," and a shaping machine as a "shaper." These terms have come down to them from the early days when the machines they represent were conceived, and probably named, in the minds of the pioneers of mechanics.

By reason of the fact that my personal acquaintance includes many practical men who call the machine in question a grinder, and, so far as I can call to mind, none who voluntarily call it a grinding machine, my guess is that if Mr. Norton could get a consensus of opinion from conservative American mechanics he would find himself very wide of the mark.

Besides being wrong, Mr. Norton is also inconsistent. We do not call a person who cooks a "cooker," but the inference is that he would call a person who grinds a "grinder." We *do* frequently refer to a sort of machine in which cooking is done as a cooker; while Mr. Norton objects to calling a machine in which grinding is done, a "grinder."

In my opinion the English language (or any other) is not a fixed, insentient thing, ironbound by a set of arbitrary rules and conditions; but a living, growing entity, born of necessity and reared by custom, to give expression to the intelligence of men. That is right which is sanctioned by common usage over a period of years sufficiently long to eliminate undesirable, unworkable, or otherwise objectionable features.

Mr. Norton as a maker of machines for grinding has a perfect right to call them grinding machines or anything else he sees fit, but there his right to monkey with the nomenclature ends. The people who use the machines will find a name to fit them, and this name will become fixed by constant use and association beyond the power of the philologist to alter it.

I am unaware as to whether or not Henry Ford, when he started the manufacture of automobiles, decided upon a name by which his product should be known, but if he did I am tolerably certain that it was not the name now in common use; yet there are few people, in this country at least, who do not know what a "flivver" is.

Which Side Do You Stand On?

By Sandy Copeland

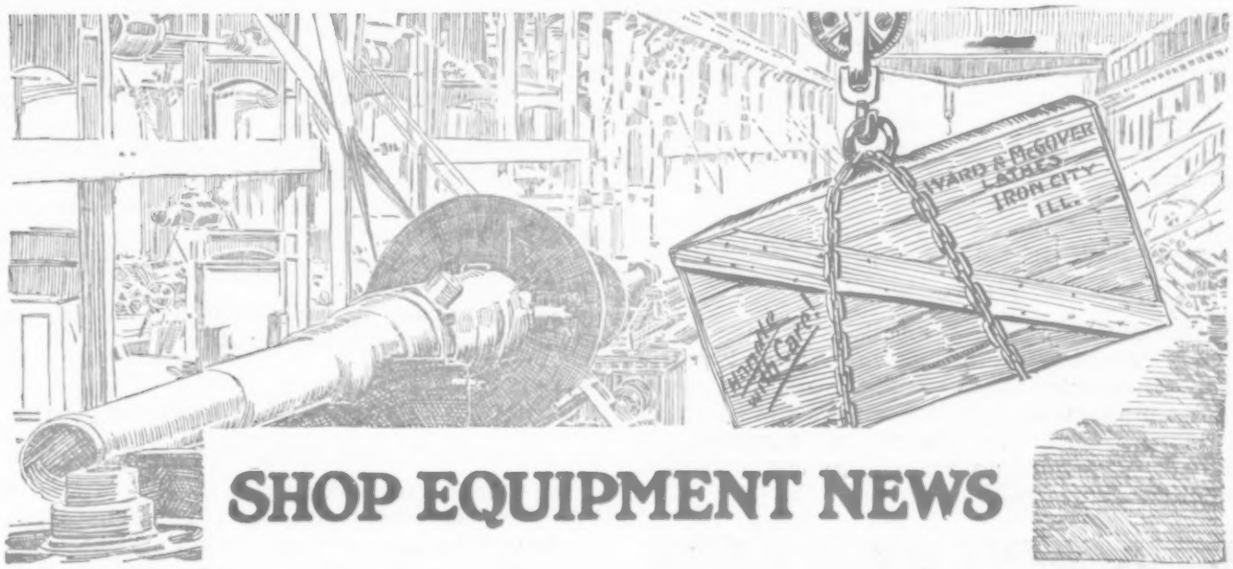
During the late unpleasantness we often heard it said of a would-be toolmaker that he "didn't know which side of a lathe to stand on."

While admitting my belief that a man should stand in front of a lathe if he expects to do anything with it, I want to ask some of the old-time readers of this journal which side of a planing machine they would stand on to operate it.

I don't mean would they stand on the front side, back side, operating side, or off side; but would they stand on the right, or the left, side?

Also, on which side of a crank shaping machine are the cone and feed works?

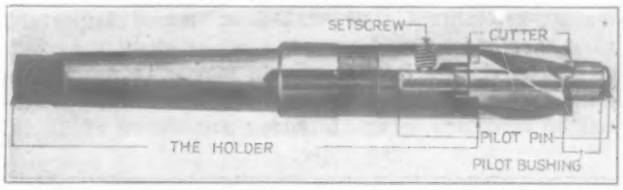
Please answer—one at a time.



SHOP EQUIPMENT NEWS

Cost-Cut Counterbore

The Cost-Cut Counterbore Co., 74-78 Fort St., East, Detroit, Mich., has placed on the market a built-up, renewable counterbore. The illustration shows the construction of this tool which is made up from the five following pieces: holder, cutter, pilot pin, pilot bushing and setscrew. It is claimed that the only perishable



COST-CUTTER COUNTERBORE

parts of this tool are the cutter and pilot bushing and that the cutter can be resharpened again and again until used up.

Holders are made in five sizes with a selection of taper shanks for each and will carry cutters ranging in size as follows: No. 1 holder—Morse taper Nos. 1 or 2; range of cutters, $\frac{1}{4}$ to $1\frac{1}{16}$ in. No. 2 holder—Morse taper Nos. 2 or 3; range of cutters, $\frac{3}{4}$ to $1\frac{1}{16}$ in. No. 3 holder—Morse taper Nos. 2 or 3; range of cutters, $1\frac{1}{8}$ to $1\frac{9}{16}$ in. No. 4 holder—Morse taper Nos. 3 or 4; range of cutters, $1\frac{9}{16}$ to $2\frac{1}{16}$ in. No. 5 holder—Morse taper Nos. 3, 4 or 5; range of cutters, $2\frac{1}{8}$ to 3 in. or over.

Black & Decker Portable Electric Compressor

The compressor outfit shown is completely automatic in operation, and is classified as No. 46 by the manufacturer, the Black & Decker Manufacturing Co., Baltimore, Md. It was designed primarily for the inflation of pneumatic tires used on trucks which require more air at higher pressure than ordinarily, but it is capable of use in other fields of industry. It has a capacity of 6 cu.ft. per minute at a pressure of 200 lb. As may be noted from the illustration, the motor, engine, gearing, etc., are all completely inclosed in a single housing, which is easily removable in three sections. The machine is positively air-cooled, and it is said that it will run 24 hr. continuously, pumping against 150 lb. pressure. The entire machine is lubricated by grease, requiring renewing but three times a year.

The cooling chamber at the top of the compressor is provided with fins to dissipate the heat. There is an automatic switch that starts the motor when the tank pressure drops to 150 lb., and stops it when the pressure has reached 200 lb. There is also an automatic unloader as a protection to the electric circuit

BLACK & DECKER PORTABLE ELECTRIC COMPRESSOR

when the motor is started. By removing the wheels the unit can be bolted to the floor, as lugs are provided for that purpose.

The outfit is well finished and is complete with all necessary equipment ready to run, including 25 ft. of special woven hose. The electric equipment can be furnished for direct current at 110 or 220 volts, or

for alternating current, two- or three-phase, at 220 volts. Another outfit with a larger engine but the same design, known as No. 412, has a capacity of 12 cu.ft. per minute at 75 lb. pressure. This outfit is recommended by the makers as especially suitable for pneumatic tools, paint spraying, machinery blowing, flame work, etc.

Keller Machine for Shaping Airplane Propellers

Propellers for airplanes are built up of many pieces of wood glued together and to finish them from the rough by hand work is a slow and tedious job. During the war, in the haste to produce air craft in quantities and in the shortest time possible, the manufacturers put it up to machine designers to get out a machine for finishing the propellers.

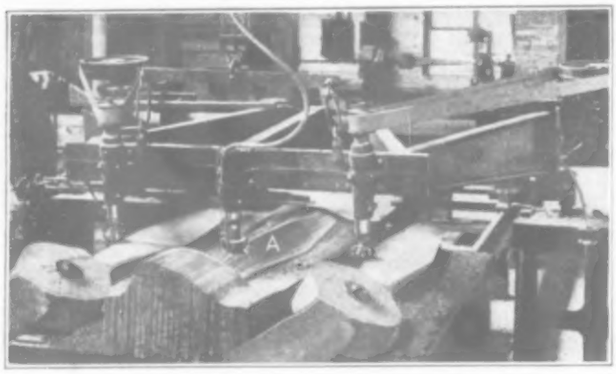


FIG. 1. PROPELLER-SHAPING MACHINE WORKING ON TWO PROPELLERS AT ONCE

The illustrations show a machine built for this purpose by the Keller Mechanical Engraving Co., Brooklyn, N. Y. This machine has cut to size from the rough 50 propellers in 8½ hours. In designing the machine, in order to save the time necessary to make patterns, parts of it were built up from commercial steel shapes.

The model *A*, Fig. 1, was cut from an accepted propeller and is used in the middle of the machine, while two propellers are mounted by it, one on each side.

As will be noted, but one blade of each propeller is being worked on and when these are finished the propellers are given half a revolution, presenting the other blades to the cutters. For finishing the other sides of the blades, the propellers will be turned over.

FIG. 2. PROPELLER-SHAPING MACHINE (SHOWING DUPLICATE FIXTURES)

Fig. 2 shows the whole machine and here will be seen at the rear an extra fixture on which a model and one propeller are mounted. When the propellers on which the machine is working are finished, the work table will be shifted along to bring the fixture at the rear into the working position and the fixture with the finished propellers will be unloaded and again loaded while the machine is at work.

The illustrations show the machine so clearly that a detailed description is not necessary.

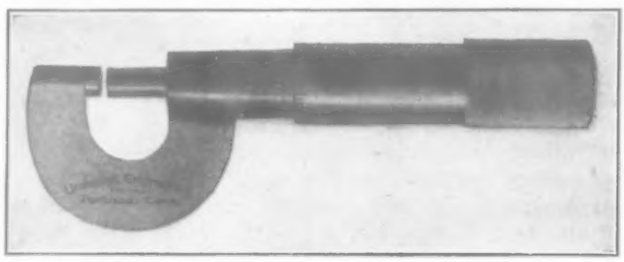
Quigley Boxes for Carbonizing and Annealing

The Quigley Furnace Specialty Co., 26 Cortlandt St., New York, has placed on the market a line of steel boxes for carbonizing and annealing. It is claimed that these boxes are made of special analysis steel, known as Q-steel, which gives maximum resistance to oxidation coupled with minimum cost per heat hour of service.

Lindquist Ten-Thousandth Micrometer

The Lindquist Engineering Works, Portland, Conn., is manufacturing a micrometer caliper to measure directly in ten-thousandths of an inch. The tool, shown in the illustration, is not unlike the regulation micrometer in appearance, but embodies several important differences in construction.

The barrel, which is somewhat larger in proportion to the frame than in the ordinary instrument, is graduated 40 divisions to the inch for a distance of 1¼ in.



LINDQUIST TEN-THOUSANDTH MICROMETER

The extension of the barrel is threaded, 40 pitch, and the thimble fitted to screw over it as in the regular micrometer. The beveled edge of the thimble is graduated to 50 divisions instead of 25.

The measuring spindle is splined to the frame and does not turn. Its outer, or inclosed end is threaded 50 pitch and screws into an inner sleeve which is attached to, and turns with, the thimble. When the thimble is turned forward through one full turn it of course advances 1/40 or 0.025 in. but this revolution has at the same time withdrawn the measuring spindle into the inner sleeve 1/50 or 0.020 in., leaving an actual advance of the spindle equal to the difference in pitch between the two threads, or 0.005 inch. One-fiftieth of one turn—one division of the thimble—thus equals 0.0001 inch.

The total range of each tool is therefore one-quarter of an inch. They are made in all sizes from ¼ to 6 inches.

This is our delayed issue of Dec. 18, 1919. This news is, however, up to date, having been prepared for our Dec. 25 issue.

Sparks from Industry's Forge

Edited by E. C. Porter

Sixty Million Francs in Record Automobile Sale

An account of what probably constituted the largest single automobile order ever given in France appeared in a recent issue of *Le Temps* of Paris. Both seller and buyer are associated with an American concern — Gaston, Williams & Wigmore, Inc., New York. The Gaston, Williams & Wigmore Co. of Paris sold several thousand Citroen, Sigma and Voisin automobiles to Gaston, Ltd., of London, the amount involved being reported to exceed 60,000,000 francs. At the Olympic Automobile Show in London recently the entire allotment of these cars was sold for 1920 delivery to British users.

Andre Citroen, says *Financial America*, is the first French automobile manufacturer to adopt American methods in quantity production of automobiles, and it is predicted that 2000 Citroen cars will be manufactured in January, 1920.

* * *

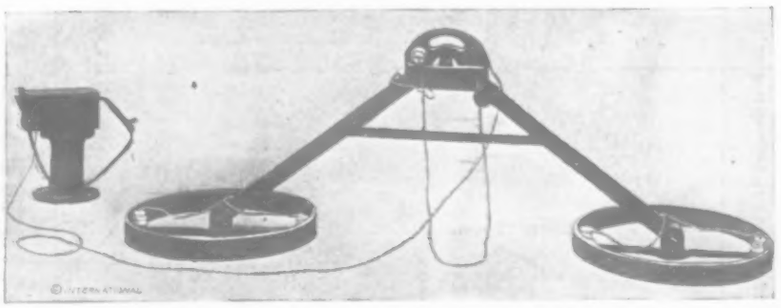
Honorary Degree of Doctor of Engineering Conferred Upon Charles Eugene Schneider

The honorary degree of Doctor of Engineering was conferred upon Charles Eugene Schneider, president of the French Industrial Commission to the United States, by Dr. Alexander C. Humphreys, president of the board of trustees of Stevens' Institute of Technology, Hoboken, N. J., Nov. 24, 1919, before representatives of the various branches of the engineering profession, the faculty and student body of the Institute.

Dr. Schneider is a noted iron master who is at the head of the Creusot Iron Works comprising a chain of 30 industrial and manufacturing plants in France. He was elected president of the British Iron and Steel Institute in 1918 and is honorary president of the Comite des Forges de France. He is now making a visit to the United States as president of the French Industrial Commission, with the object of securing the coöperation of American manufacturers and engineers in the reconstruction of the engineering profession to a peace basis.

Dr. Humphreys made the introductory remarks and briefly outlined the accomplishments of Dr. Schneider as an engineer, telling why it had been decided to confer the degree upon him.

Greetings from five of the prominent engineering societies of the United States were offered by their representatives, who were: Nelson P. Lewis, vice president of the American Society of Civil Engineers; Dr. Henry M. Howe, of the American Institute of Mining and Metallurgical Engineers; Mortimer S. Cooley, president of the American Society of Mechanical Engineers; Calvert Townley, president of the American Institute of Electrical Engineers, and J. V. Davies, representing Lewis B. Stillwell, president of the American Institute of Consulting Engineers.



DETECTOR GOING OVER BATTLEFIELD TO LOCATE UNEXPLODED SHELLS

THE first experiments with the Zutton scales devised by Professor Zutton, a French inventor, were held on the battlefields of Laneunelotte and Champenoux. The device was constructed with the idea of locating unexploded shells buried in the ground. The great battlefields of France and Belgium will be carefully gone over to gather up all the shells which will remain objects of great danger to farmers and townsfolk for many years to come. The machine is now being used extensively by hydraulic engineers. When the scales are laid on the ground within the vicinity of an unexploded shell, the apparatus starts functioning and the telephone arrangement rings slightly.

* * *

New Britain Machine Co. To Build $40,000 Shop

The New Britain Machine Co. has been issued a permit to build a factory addition to cost $40,000. The addition will be erected on Chestnut St. on property recently acquired by that company and will be 32 x 320 ft. The materials used in building will be cement, glass and steel, making a factory similar to the Government shop at the corner of Bigelow and Chestnut Streets.

Trade Currents from Cleveland, Chicago and Philadelphia

CLEVELAND LETTER

Production of equipment continues up to normal. There is not a normal demand at present, but this is looked for with the inventory taking during the last few weeks of the year. Much of the new production is for future delivery on orders placed previous to Dec. 1. There are a lot of individual interests dependent on or related to the machinery industry which are being affected by the fuel shortage, and this also is causing a slowing down in demand.

More new firms being brought to Cleveland through the activities of the Industrial Development Committee are expected to mean larger outlet for equipment after the beginning of the year. Among possible machinery users are the J. W. Murray Auto Hood Co., a $3,000,000 corporation; Bailey Meter Co., steam power gages; American Tube and Pipe Bending Co., boiler parts; Pierce Plating Co., plated parts; Drew Electric Co., electrical equipment; Coburn Machine Co., automobile radiators; King Tool Co., machine parts; Marsh Motor Car Co., automobiles.

Newest equipment firm to enter the Cleveland field is the Walcott Lathe Co., Jackson, Mich., manufacturers of lathes, shaping machines and die sinkers. Display rooms and offices have been opened at 1316 Ontario St. The Cleveland branch will be under the management of Frank H. Wheaton, well known in the Central West in this particular branch of the machinery industry.

The Cleveland branch will be known as the Ohio district. For the present the Eastern half is being covered, and later the entire state will be handled from this branch. Mr. Wheaton has associated with him George L. Penty of Cleveland, and plans to add other representatives to his staff. Other branches of the Walcott Co. have been established at Detroit, Syracuse, St. Louis and Chicago.

One of the first concerns in the machinery industry to complete plans for profit sharing with employees for this Christmas is the Cleveland Twist Drill Co. More than 1000 employees who have been in the employ of the company six months will share in the profits. A benefit association, one of the first of its kind in the machinery industry in this section, has been started by the employees of the Cleveland Milling Machine Co. The organization will be known as the Cleveland Milling Machine Co.'s Employees' Association. Its main object will be to make for relief of sick and injured members. Another important feature, in line with the greater coöperation between employer and employee in the industry, is that this association is expected to create a feeling of good will among members in the organization. Chief requirement for membership in this body is that applicants be in good health at the time they turn in their membership blanks.

An entrance fee is charged, also a small monthly fee, the rate of the latter decreasing as soon as the total amount of money received has reached the sum which will pro-rate at $5 a member. In case of sickness or disability each member will receive a small amount weekly for a period of 13 weeks. In case of death each member will be assessed $1 which will be paid to the beneficiary of the deceased.

Officers of the association are: President, E. C. Clapp; vice president, H. W. Gibson; financial secretary, Frank Krug; recording secretary, Ed. Wadeson; treasurer, C. Longo; executive committee, R. Whitfield, R. Bronson, D. C. Heims. There are 150 members in the association at present. The Cleveland Milling Machine Co. has between 300 and 400 employees.

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Box containing battery, condenser, vibrator and other apparatus used in connection with the detector shown on the page preceding

Chicago Letter

Two years of war conditions followed by one year of strenuous peace has accustomed the machine-tool trade to expect the unexpected; hence serious restrictions to business due to the coal shortage have been met with a minimum of friction and with an entire absence of worry. All classes of mercantile industry having been limited to a 6½-hr. day, the machinery dealers are operating from 9:00 a.m. to 3:30 p.m., and by application and strenuous effort are getting out the day's work on time.

But slight diminution in volume of business has appeared, traceable to the coal strike and, on the whole, December still promises to be a better month than in previous years. Due to the close approach of inventory time, a letup in orders is to be expected, but so far, both inquiries and actual purchases are coming in surprising quantity. Probably not so much goods on back order will be delivered as was anticipated, as the manufacturers are now compelled to work only 36 hr. a week and a reduction in their output will naturally follow.

Deliveries are getting no better, and no improvement is to be looked for. Milling machines, turret lathes, radial drilling and punching machines are most in demand, delivery ranging from 60 to 120 days, depending on the particular make or size required. Punching machines continue to be the prize of the market, and dealers fortunate enough to secure deliveries are enjoying quick sales.

The effects of the late steel strike are being felt in some ways. The long shutdown of the largest producer of tin plate, and its subsequent reduced output has produced an acute shortage. So far, conservative dealers have managed to maintain prices at the old level, but are by no means able to fill all demands of even their regular customers. The pinch is being felt by washing-machine and automobile-body builders and is probably holding back machinery buying by the industries to a certain extent. Unfortunately, the situation does not show any signs of immediate improvement.

A shortage is also developing in bolts and nuts. An increase of about 5 per cent. was made in prices a few weeks ago, and now, on account of a shortage in production of the rod material, from which bolts and nuts are made, no supplies are being received. Chicago jobbers are understood to be well stocked and it is not believed the shortage in this line will become acute.

Philadelphia Letter

Despite the approach of Christmas and the prevailing holiday season, dealers in new equipment report sales for the first half of December to be quite equal to the high standard set during the two months previous.

Houses dealing in second-hand machinery, however, have noticed the usual falling off in business due to the fact that many buyers have postponed purchasing until after the first part of the new year. Business continues to be good although not quite as active as during last month.

Falling off in the sale of second-hand equipment may be partly attributed to many manufacturers having grown tired of the present two to four months' delay in delivery. These plants have installed machine shops and are doing much of their own repair work rather than await long shipments of inferior quality at exorbitant prices.

The effect of Government sales is still felt to some extent by this class of dealers although not as much as might be expected. The Government continues to charge prices about equal to the market cost and most of this equipment goes into machine-tool dealers' warehouses. It is rumored that a central clearing station for Government machinery will be established at the Eddystone rifle plant at Eddystone, Penn. There is still said to be a large amount of equipment on hand, although most of it is of an inferior quality.

Heavy tools are still in demand. Lathes, drilling and milling machines, in particular are wanted in large numbers.

Prices for machinery have been going up steadily. Any decrease in the supply of machinery, due to labor shortage, has produced a corresponding increase in demand for equipment. One local house has refused, absolutely, to sell drilling machines except for the prevailing price at the time of delivery.

The low rate of exchange is keeping foreign buyers out of the market. It is hoped that a fair rate of exchange will be established soon, as foreign manufacturers are in the market for machinery, and would no doubt place a large proportion of their orders here, if a fair rate of exchange prevailed.

Local buyers are, for the most part, purchasing in one- or two-piece lots. No long lists of requirements have been issued lately and demands for one hundred or more machines appear to be something of the past. Ship builders are buying tools, but the railroads are inactive, and continue to wait for more settled conditions.

The shortage of iron castings has crippled manufacturers to a large extent, and those unable to manufacture them have been hard put to make their usual production.

Reconstruction Task Confronting France

M. Labbe, director general of Technical Services, France, gives some facts regarding the magnitude of the reconstruction task confronting the French Minister of Liberated Regions, in Commerce Reports, Nov. 29: Building work alone would require 22,000,000 tons of material, and labor, 700,000 people for one year; 100,000 houses are to be entirely rebuilt, requiring 5,000,000,000 bricks, 3,000,000 cubic meters of sand, 1,000,000 tons of lime, 13,000,000 square meters of tiles and 3,000,000 cubic meters of wood. Reconstruction of highways and railroads would require 3,000,000 tons of materials, and labor, 15,000 men for one year. An addition of 20,000 trains and 5000 trucks would be required.

* * *

Army Plans for Vocational Training Nearing Completion

Army plans for vocational training are nearing completion. An appropriation of $2,000,000 for that purpose is available during the current fiscal year. Among the various classes of training which are to be given is the machine department where instruction will be given in instrument repairing, general and special mechanics, machine designing, mechanical drafting, free-hand sketching and instruction pertaining to the trade of foundryman, general machinist, toolmaker and patternmaker.

In the automotive department, instruction will be given in truck, tractor and motorcycle repairing, and every effort will be made to develop specialists in the handling of storage batteries and the repair of tires. In the metal department, blacksmithing, plumbing, pipe fitting, sheet metal working and welding will be taught.

* * *

Pneumatic Tool Co. Holds Sales Meeting

The Independent Pneumatic Tool Co., general offices, No. 600 West Jackson Boulevard, Chicago, recently held a sales meeting at which branch managers and representatives from the North, South, East, West and Canada were in attendance.

The meeting was in charge of the vice president and the general sales manager, R. S. Cooper. Other officials of the company in charge were John D. Hurley, president; F. W. Buchanan, secretary; Adolph Anderson, assistant to president; F. B. Hamerly, works manager; Axel Levedahl, consulting engineer, and R. A. Norling. One whole day was spent at the factory with the mechanical departments.

* * *

Sale of Electric Generator Sets

The Director of Sales announces that the Surplus Property Division, Office of the Quartermaster General of the Army, is offering for sale 400 gasoline driven, electric generator sets, with switchboards and gasoline tanks, which have been declared surplus by the War Department and on which offers will be received at any time by the Surplus Property Division, Munitions Building, Washington, D. C.

The sets which the Government is offering for sale are new and have been carefully stored since they were purchased by the Government about a year ago. They are packed in the crates in which they were shipped from the factory. They are located at Schenectady, N. Y., and New Cumberland, Penn., and will be shipped promptly upon approval of submitted offers.

Inspection of the machines, switchboards and tanks may be made at the points of storage or complete specifications may be obtained from the Surplus Property Division, Munitions Building, Washington, D. C. Information relative to the terms of sale, storage points, etc., may be obtained from the same office.

Group Insurance Taken Out for Employees

The Automatic Refrigerating Co., Hartford, Conn., manufacturer of automatic refrigerating machinery, with plant located at Willow St. and Capitol Ave., has taken out a group life insurance policy on its employees, numbering about 200.

Workmen who have been with the company a month get insurance of $250; and at six months service, this is extended to $500; at a year, $600, and so on in sums of $100 each six months up until three years service when it reaches $1000. After reaching the $1000 insurance the increases take a $100 jump every year until the maximum of $1500 is reached.

Employees who have been with the company for a number of years will be entitled to the increased sum at once. Any employee who has been in the Gov-

Domestic Exports of Metal-Working Machinery from the United States by Countries During October, 1919

Countries	491 Lathes	492 Other Machine Tools	493 Sharpening and Grinding Machines	495 All Other
Austria-Hungary	.....	.....	.....	$64
Belgium	$68,215	$6,666	$45,238	146,565
Denmark	1,034	3,760	620	29,452
Finland	.....	4,685	1,902	.....
France	263,383	200,487	106,416	1,496,506
Germany	.....	.....	272	6,980
Italy	17,549	45,943	16,806	117,305
Netherlands	2,035	4,049	1,334	9,116
Norway	7,144	16,853	3,123	14,773
Portugal	2,125	1,589	225	1,023
Roumania	4,856	.....	.....	.....
Russia in Europe	.....	571	.....	.....
Spain	31,204	29,241	25,084	86,538
Sweden	14,948	14,842	23,421	21,558
Switzerland	.....	10,549	475	1,385
England	167,868	236,221	80,272	457,495
Scotland	.....	48,804	.....	779
Canada	30,893	149,003	122,795	181,432
Costa Rica	.....	1,038	.....	.....
Guatemala	1,320	.....	36	.....
Honduras	3,933	.....	.....	2,959
Nicaragua	.....	499	.....	.....
Panama	2,858	241	206	4,135
Salvador	.....	.....	20	.....
Mexico	1,042	7,330	498	5,663
Newfoundland and Labrador	31	67	.....	336
Barbados	20	.....	.....	5,477
Jamaica	899	304	.....	.....
Trinidad and Tobago	1,725	32	837	.....
Other British West Indies	.....	.....	4	.....
Cuba	35,173	42,306	2,208	21,151
Danish West Indies	.....	.....	22	.....
French West Indies	.....	414	.....	.....
Dominican Republic	.....	320	.....	.....
Argentina	8,553	7,723	566	11,427
Bolivia	.....	228	.....	195
Brazil	18,804	12,234	456	5,575
Chile	7,140	3,235	689	42,525
Colombia	.....	161	43	1,814
Ecuador	.....	271	96	2,253
British Guiana	.....	520	.....	.....
Peru	928	877	141	9,772
Uruguay	.....	912	.....	2,461
Venezuela	1,950	270	.....	.....
China	8,752	2,107	574	13,085
Japanese China	.....	.....	.....	270
Chosen	.....	285	.....	259
British India	6,969	2,895	7,521	8,871
Straits Settlements	.....	595	70	37
Other British East Indies	.....	40	.....	.....
Dutch East Indies	5,105	9,628	1,224	8,677
Hongkong	421	252	.....	282
Japan	26,191	21,248	17,329	74,619
Russia in Asia	18,981	15,148	400	6,791
Siam	.....	53	56	130
Australia	7,407	11,841	857	82,248
New Zealand	650	2,776	2,355	4,758
French Oceania	.....	.....	30	.....
German Oceania	.....	.....	.....	10
Philippine Islands	9,738	3,369	210	3,834
Belgian Kongo	.....	160	.....	.....
British West Africa	960	.....	176	870
British South Africa	3,100	4,826	3,741	5,573
Morocco	.....	.....	.....	85
Portuguese Africa	.....	413	85	.....
Egypt	1,050	.....	530	665
Total	784,964	927,881	468,963	2,897,778

ernment service, and worked with the company previous, will also be entitled to the insurance. Any employee becoming permanently disabled before reaching 60 years of age, will receive the full amount of insurance in force upon his life.

* * *

To Export Foundry Equipment

Articles of incorporation, under the Webb law, have been filed with the Federal Trade Commission by the Foundry Equipment Export Corp., 40 Wall St., New York.

The following are the officers of the new incorporation: T. S. Hammond, Whiting Foundry Equipment Co., Harvey, Ill., president; L. L. Munn, Arcade Manufacturing Co., Freeport, Ill., first vice president; E. J. Woodison Co., Detroit, Mich., second vice president; V. E. Minnich, American Foundry Equipment Co., New York City, treasurer; S. T. Johnston, Obermayer Co., Chicago, secretary. The other directors are W. C. Norcross, American Molding Machine Co., Terre Haute, Ind.; R. S. Buch, Buch Foundry Co., York, Penn.; George L. Grimes, Grimes Molding Machine Co., Detroit.

* * *

Report of the Chief of the Motor Transport Corps

Under date of Oct. 10, 1919, the Motor Transport Corps has issued its first annual report for the fiscal year ended June 30, 1919. A brief account of the evolution of this branch of the Army opens the report and the various army orders controlling its organization and operation are included in appendices.

The functions of the various divisions are described in some detail and a short account of their respective achievements is also given. This covers only the work in this country as the work on the other side will be covered in the report of the commanding general of the A. E. F.

Other appendices contain the tables of organization, the official symbols adopted to designate the various models and a list of the 216 different makes of automotive vehicles purchased by the Army.

* * *

Invents a New Steel

The invention of a new steel, far in advance of any high-speed steel hitherto made, according to a dispatch from London, is claimed by John Oliver Arnold, professor of metallurgy at Sheffield University.

Professor Arnold, who is said to have been the discoverer of vanadium steel, claims that the new steel possesses far more commercial possibilities, that it is unrivaled in hardness, that in tool form it will remove a greater weight than any other steel, and that it possesses comparatively longer life.

Professor Arnold, says the newspaper, is prevented under the defense of the realm act from utilizing his invention industrially. He is patenting his invention in England and America, and will be allowed to proceed with his American patent on condition that he publishes nothing concerning it.

A representative of the American Government, it is said, made a special journey to Sheffield to investigate Professor Arnold's discovery.

* * *

Ordnance Draftsmen Wanted

The Ordnance Department is carrying on a great deal of new design work, the details of which will be handled at the arsenals. The Rock Island Arsenal is at present building up a force of 50 to 100 draftsmen (designers, detailers and tracers) to handle this work. Applications for positions will be received. Address the Commanding Officer, Rock Island Arsenal, Rock Island, Ill.

* * *

Consolidates Office and Factory

The Norma Co. of America, manufacturer of precision bearings, on Dec. 10 moved its factory from the Bronx, New York City, to Anable Ave., Long Island City, New York, where a modern four-story reinforced concrete building has been acquired. Under the new arrangement a largely increased factory space is secured. The executive offices at 1790 Broadway have been consolidated with the factory at the new address.

Business Items

The Auto Wood Stock and Ladder Co., Fremont, Ohio, has taken over the plant of the Reversible Window Co., and will operate it in conjunction with its former plant.

The Crompton and Knowles Loom Works, manufacturer of textile looms and machinery, Worcester, Mass., has issued an announcement to its employees establishing a health service for all the workers of the corporation.

The Sterling Blower Co., Hartford, Conn., manufacturer of blowers and blower systems, has opened a branch office in Philadelphia at 1505 Poplar St. The company now has branch offices located at New York, Boston, Rochester and Philadelphia.

The Rhode Island Machine and Tool Co., Woonsocket, R. I., has been incorporated, and will manufacture machines and machine tools. The officers are H. Eugene Getchell, president; Raynaldo Jacques, vice president; Arthur Jacques, secretary and treasurer; Wilfred Jacques, general manager.

The A. Burlingame Co., Worcester, Mass., located at 22 Cypress St., for a number of years, has announced its removal to its new building at 149 Commercial St., a building bought and remodeled by the company some time ago. The company manufactures steam engines, general power transmission, shafting, sprinkler systems, etc.

The Heald Machine Co., Worcester, Mass., manufacturer of grinding machines and magnetic chucks, has transferred L. C. Kenyon, who for the last two years has been in charge of the New England territory, to the Chicago office, to be assistant to G. A. Pabst, who is in charge of the Chicago territory. Mr. Kenyon's place in the Worcester plant will be taken by M. F. McCormick, who was formerly connected with the firm of Sparritt & Stoer Co., Philadelphia.

The Doehler Die Casting Co., with its main office and plant at Brooklyn, N. Y., and a branch office at Toledo, Ohio, has just closed the purchase of a seven-acre tract in Chicago, Ill. The company will erect a modern one-story concrete steel and brick structure for the manufacture of die castings and bearings. Contract for the building has already been let and operations started. The building is to be completed and ready for occupation and operation on or about Jan. 1, 1920.

Personals

FRANK GREINER, for the last three years chief service engineer at the Heald plant, has resigned his position.

H. F. AARION, formerly with McMinn & Quigley Steel Co., has accepted a position with the M. A. Palmer Co., Boston, Mass.

C. E. Mason, who for the last 24 years has been with the Graton and Knight Manufacturing Co., Worcester, Mass., with the sales force, has resigned his position.

R. C. MOORE, who has been connected with the Graton and Knight Manufacturing Co., Worcester, Mass., in the capacity of advertising manager for the last eight or nine years, has severed his connection with the company.

CHARLES F. TREADWAY, who has been treasurer of the New Departure Manufacturing Co., Bristol, Conn., for several years, having succeeded his father, Charles S. Treadway, in that position, resigned on Nov. 1. His successor will be William E. Wightman, who has been the assistant treasurer for some time past. Mr. Treadway is the president of the American Trust Co., and also of the Bristol National Bank. He will devote most of his time to these enterprises.

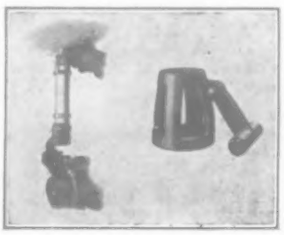
Obituary

CHARLES MATTHEW HART, age 67, general manager and principal owner of the Hart Machine Shops and stockholder in many banks and business enterprises, died at his home in Clarksburg, W. Va., Dec. 3. He was born and spent his entire life in Clarksburg. Mr. Hart attended West Virginia University, University of Athens, Ohio, and Cornell University. He served in the state legislature and the city council.

Condensed-Clipping Index of Equipment

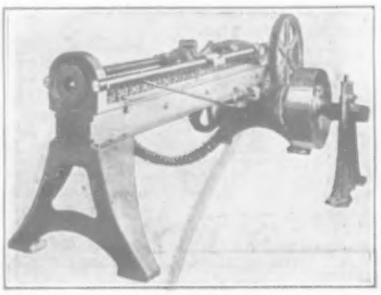
Clip, paste on 3 x 5-in. cards and file as desired

Holder, Pneumatic Hammer, "Boyergrip"
Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill.
"American Machinist," Sept. 4, 1919.



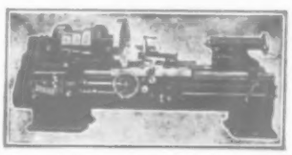
The device combines a hammer grip with a safe set retainer and affords the operator a firm hold of the tool without danger of squeezed fingers or burns from the heated cylinder or hot rivets. It gives an unobstructed view of the work and provides protection in chipping when the chisel slips or is accidentally shot from the holder.

Draw Bench
Winterhoff Tool and Machine Co., Elkhart, Ind.
"American Machinist," Sept. 11, 1919.



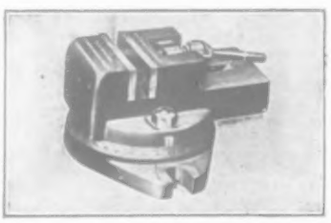
The carriage runs on heavy guides, and a safety trip is provided which will stop the carriage at any desired place. The use of the guides shown keeps the carriage in correct relation to the drawhead at all times, thus eliminating any tendency to produce waviness in the tubing being drawn. The chain is of the standard roller-link type, with a capacity of fifteen tons. The back gear ratio is 150 to 1. Maximum diameter of tubes handled, 3 in.; drawing stroke, 5 ft.; floor space, 4 x 8 ft.; weight, 2000 lb.

Lathe, 28-In. Severe-Duty
Cincinnati Lathe and Tool Co., Cincinnati, Ohio.
"American Machinist," Sept. 11, 1919.



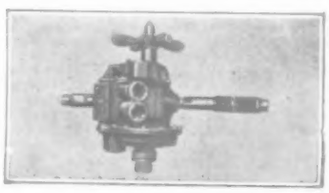
Front bearing, 4¼ in. x 7¾ in.; back bearing, 3⅜ in. x 5⅜ in.; width of belt, 5¼ in.; hole through spindle, 2⅛ in.; cutting tool size, ⅞ in. x 1¾ in.; diameter nose of spindle, 4 in.; diameter of tailstock spindle, 3⅜ in.; length of carriage bearing on bed, 36 in.; ratio of back gears, 12¼ and 3⅜ to 1; diameter of countershaft pulleys, 16 in. x 5½ in.; speed of countershaft, 185 to 225 r.p.m.; lengths of bed, 10 ft. to 30 ft.; distance between centers, 10-ft. bed, 60 in.; weight (net) 10-ft. lathe, 7100 lb.; weight per extra 2 ft., 520 lb.

Vise, Quick-Acting Swivel-Base
Nestor Manufacturing Co., 40 West 13th St., New York City.
"American Machinist," Sept. 11, 1919.



For use on milling or drilling machines. It is made with a graduated swivel base which gives it obvious advantages over the plain type which the company had previously manufactured. The construction of the adjusting screw makes secure clamping easy and certain. The vise is adjusted from minimum to maximum capacity by a few turns of the screw. The vise jaws are hardened and ground. The vise is made in four sizes of 2½, 4, 6 and 9 in. capacity.

Drill, "Little Giant" Air
Chicago Pneumatic Tool Co., Chicago, Ill.
"American Machinist," Sept. 11, 1919.

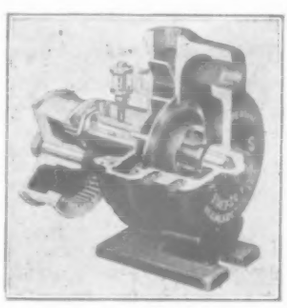


Latest model shows following changes: crankshaft made of special heat-treated steel and supported at three points by annular ball bearings, stub teeth on pinion, connecting-rods have ball-and-socket bearing in pistons which prevents side strain and undue wear, crankpin bearings of replaceable bronze, one-piece pistons hardened and ground.

Drilling Machine, Wisconsin All-Gear-Driven
The Dauber-Kratsch Co., Oshkosh, Wis.
"American Machinist," Sept. 11, 1919.

Drill to center of circle, 20¾ in.; spindle movement, 8 in., maximum distance spindle to base, 41½ in.; maximum distance spindle to table, 29 in.; minimum distance spindle to base, 26½ in.; movement of sliding head, 7 in.; diameter of table, 20 in.; Morse taper hole in spindle, No. 4; total height to top of spindle, 83 in.; floor space, 18 x 40 in.; working surface of base, 18 x 19 in.; drive pulley, 10 x 3½ in.; four single speeds with single pulley drive; four feed changes for each spindle speed, 0.007 in., 0.010 in., 0.018 in., 0.025 in.; net weight, 1000 lb.

Pump, "Fulflo" Reversing
Fulflo Pump Co., Blanchester, Ohio.
"American Machinist," Sept. 11, 1919.



Reversing feature obtained through design of impeller blades and introduction of bronze deflecting gate in discharge passage. Both openings at top of pump make it always primed. Mounting pad detachable and may be located in any one of three positions at 90 deg. Capacity, 15 gal. per minute with 5 15-in. suction lift against 4-ft. head, pulley speed of 450 r.p.m., ¾-in. pipe. Capacity can be increased by enlarging pipe and raising speed of pulley.

Seam-Planishing Machine
Winterhoff Tool and Machine Co., Elkhart, Ind.
"American Machinist," Sept. 11, 1919.

Designed for rolling brazed seams in band instrument factories, but may be used for a wide range of work. In use, the work is placed in the machine, seam up, on a hardened-steel mandrel. The roll may be either flat or concave faced. This roll is adjusted by means of a handwheel that operates three gears on the elevating screws. The collar on the handwheel is graduated in thousandths. This table is driven by means of back gearing which meshes with a rack under it.

Size of table, 8 x 71 in.; rate of table travel, 6 ft. per minute; length of stroke, 71 in.; floor space, 2 x 6 ft.; weight, 1800 lb.

Patented Aug. 20, 1918

Trade Catalogs

Acetylene Flare Light. Davis-Bournonville Co., Jersey City, N. J. This circular briefly describes the Davis flare light generator, and also suggests some of its many possible uses.

Universal Tapper. Lowenstein Radio Co., Inc., 397-399 Bridge St., Brooklyn, N. Y. A single folder briefly describing its universal tapping machine; also giving its specifications.

Thawing Outfits and Torches. Aëroil Burner Co., Inc., 400 Main St., Union Hill, N. J. Bulletin No. 10, 9 x 6 in. This describes and illustrates the company's thawing outfits for thawing out frozen cars, pockets, hoppers, pipes, switches, loading gates, etc.

Reamers, Twist Drills, Lathe Tools, etc. Clark Equipment Co., Buchanan, Mich. Catalog No. 17, pp. 127, 7½ x 5 in. This catalog gives a complete list of the price, size and length of all its standard tools.

Heat Insulation. The Franklin Manufacturing Co., Franklin, Penn. Catalog F. C. 7-19, pp. 77, 11¼ x 8 in. This catalog contains brief and uncolored descriptions of its products; also useful engineering information. Complete tables and concise instructions for their use are given.

Self-Opening Die Heads and Collapsible Taps. The Eastern Machine Screw Corp., New Haven, Conn. Catalog, pp. 96, 9 x 6 in. It is profusely illustrated and replete with threading information; also tables pertaining to screw cutting. The company has issued a complete price list of its die heads.

Open-hearth Furnace. McLain-Carter Furnace Co., Goldsmith Building, Milwaukee, Wis. Catalog, pp. 17, 12 x 9 in. This catalog describes its openhearth furnaces; also gives illustrations of the company's furnaces in various plants in the United States.

Automatic Portable Electric Tools. Geo. C. McKay Co., Cleveland, Ohio. Catalog, 6 x 9 in., pp. 12, illustrated. Portable electric drills, reamers, nut and bolt drivers, and lag screwdrivers are described in detail.

Ranson Disk Grinding Machine. Murray-Mylrea Machine Co., Antigo, Wis. Catalog, 8½ x 11 in., pp. 8, illustrated. The company's line of disk grinding machines is described, all dimensions being given.

Trade-Marks. Arthur Middleton, 217 Broadway, New York City, N. Y. Booklet, 3½ x 6 in., 12 pages. This booklet tells of the origin, definition, choice, precautions necessary, registration and protection abroad of the trade-mark.

The Firths Have Been Making Tool and Die Steel Since 1840. E. S. Jackman & Co., agents, Chicago, Cleveland, Pittsburgh. This is a circular giving a list of tools made from Blue Chip high-speed tool and die steel, and Firth-Sterling special tool and die steel.

The "Commercial" Annular Ball Bearings. Schatz Manufacturing Co., Poughkeepsie, N. Y. Catalog No. 4, 9 in; pp. 18, illustrated. The company's "Commercial" annular ball bearings are described, the dimensions and price list being included.

Thurston Die Milling Machine. Thurston Manufacturing Co., Providence, R. I. Folder, 8 x 11½ in., illustrated. The Thurston die milling machines and the mills used in them are described in this folder; specifications are included.

Autogenous Welding. Davis-Bournonville Co., Jersey City, N. J. October Number, 6 x 9 in., pp. 23, illustrated. This number has been published in the interest of better gas welding and cutting.

Taft-Peirce Gages. Taft-Peirce Manufacturing Co., Woonsocket, R. I. Bulletin 109, 8 x 10½ in., 32 pages, illustrated. The Taft-Peirce line of gages is described and illustrated in this bulletin. Measurements and price lists are given; measuring machine, some thread milling cutters and arbors and special cutters also being included.

The Tilted Turret. Wood Turret Machine Co., Brazil, Ind. Catalog, No. 12, 8 x 11 in., pp. 44, illustrated. Gives a full line of the company's screw machines, turret lathes, brass-working machines and extra automatic chucking turret lathes. Specifications are given as well as cuts detailing the construction.

Idle Machines. Gisholt Machine Co., Madison, Wis. This small folder briefly illustrates how to avoid idle machines.

Tool Steel Treating. Colonial Steel Co., Pittsburgh, Penn. Booklet, pp. 25, 7 x 5 in. This booklet contains the experience of its sales department, and the company offers it with the hope that it may be of use to the steel users in general.

Cutters. Moback Tool and Machine Manufacturing Co., 330 Atlantic Ave., Boston, Mass. Circular, 11 x 8½ in. A three-page circular illustrating and describing the efficiency and economy of the Moback cutter.

Standard Stock Specialties. J. H. Williams Co., Brooklyn, New York. Catalog, 6 x 4 in. A 160-page catalog fully illustrating and describing its standard stock specialties; also a description of its drop-forging process in a simple, non-technical style, for the benefit of those not conversant with its details.

Drill Chuck and Tapping Device. Landau Machine and Drill Press Co., Inc., 19-25 West 44th, St. New York. Circular, pp. 4, 11 x 8½ in. A brief description is given of the "Landau" combination drill chuck and tapping device; specifications are also given.

Milling Machines and Grinders. The Oesterlein Machine Co., Cincinnati, Ohio. Catalog, pp. 39, 11 x 8½ in. An illustrated and descriptive catalog of the design, construction and specifications of its milling machines and grinding machines.

Turret Lathes. The Fairbanks Co., Broome and Lafayette Sts., New York. Circulars 1B and 2B, 11 x 8 in. These circulars illustrate the company's machines and the tools used in the manufacture of them; specifications also included.

Screw Machines. P. W. V. Automatic Corp., Fitchburg, Mass. Booklet, pp. 23, 8½ x 5½ in. This booklet contains illustrations which were taken during actual assembly of the company's "B" or No. 1 machine.

Ball Retainers and Complete Thrust Bearings. The Bearing Co. of America, Lancaster, Penn. Catalog, pp. 25, 7½ x 4½ in. A catalog of revised data sheets, showing the various sizes of ball retainers.

Open-hearth Furnace. McLain-Carter Furnace Co., Goldsmith Building, Milwaukee, Wis. Catalog, pp. 17, 12 x 9 in. This catalog describes its openhearth furnaces; also gives illustrations of the company's furnaces in various plants in the United States.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Agencies are desired by a man in Spain for the sale of machinery. Quotations should be given c.i.f. Barcelona. Correspondence may be in English. Reference No. 31,268.

An agency is desired by a firm in the Netherlands for the sale of iron and steel goods, engines, tools, and all mechanical articles. Quotations should be given c.i.f. Rotterdam. Correspondence may be in English. Reference No. 31,284.

New Publications

Governors and the Governing of Prime Movers. By W. Trinks, M.E., Professor of Mechanical Engineering, Carnegie Institute of Technology, Pittsburgh, Penn. Pp. 217 with 140 illustrations. D. Van Nostrand Co., 25 Park Place, New York.

This volume has been written for the purpose of providing in one book the scattered information on governors which is to be found in the various textbooks on steam engineering, hydraulics and internal combustion engines. It deals with fundamentals and does not attempt to show present applications. In accordance with this plan all the illustrations are diagrams especially prepared for this book and no catalog pictures are included.

It is primarily a textbook for engineering students and consequently a working knowledge of the calculus is presupposed and a liberal use of it is made in the derivation of formulas. For the benefit of operating engineers whose mathematical education has not been as complete as they might wish, an appendix is added which gives some of the proofs by other mathematical methods.

For those who wish to go more deeply into the subject, a very complete bibliography appears at the end of the text.

Machine Tool Operation—Part 1. — By Henry D. Burghardt, Instructor Machine Work, Wm. L. Dickinson High School, Jersey City, N. J. and member of the A. S. M. E. First Edition. Three hundred twenty-six 7½ x 5-in. pages, 231 illustrations and 23 tables. Published by the McGraw-Hill Book Co., 239 West 39th St., New York.

This book is primarily designed to be used in connection with class talks or demonstrations in the school shop, although it may be used to supplement the information which a boy in the commercial shop may acquire by observation, practice, or by other means. It contains the necessary elementary information concerning machine-tool operation. This information has been set forth simply and clearly for the benefit of the student.

The chapters on lathe work are: The Machinist's Trade; Lathe Construction and Manipulation; Cutting Tools and Cutting Speeds; The Scale, Caliper, Snap Gage and Micrometer; Centering; Facing; Turning in a Lathe; Chucking Work; Tapers and Angles; Threads and Thread Cutting, Faceplate Work. Bench work and work on the forge chapters: Hammers, Screwdrivers, Wrenches, Hacksaws; Laying-Out; Chipping, Filing, Scraping; Work at the Forge.

Catalogs Wanted

The B. & C. Machinery Co., Hayward, Calif., desires to receive catalogs of machinery, tools and supplies for its machine, sheet-metal and foundry departments.

The Titan Metal Co., Bellefonte, Penn., has made considerable additions to its plant and wants to be put on the mailing list to receive literature from manufacturers making acetylene equipment, machine tools, pickling tanks and appliances, electric and air hoist, small traveling crane, monorail trolley, air compressors, steam hammers, metal tote pans, electric and gasoline factory trucks, toolmaking in die-sinking equipment and melting-room equipment.

Forthcoming Meetings

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Engineers' Club of Philadelphia, Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Manufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The motor-truck sections of the 20th Annual Automobile Shows of 1920 will hold an exhibition in the 8th Coast Artillery Armory, New York, Jan. 3 to 10, 1920, and in the International Amphitheatre, Chicago, Ill., Jan. 24 to 31, 1920.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Rochester Society of Technical Draftsmen. Monthly meeting last Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

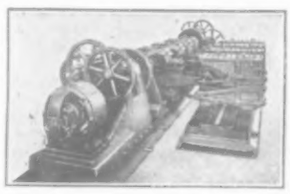
The Society of Automotive Engineers will hold its annual meeting in New York on Jan. 6 to 8, inclusive. For further information of program, address the meeting committee, 239 West 39th St.

Condensed-Clipping Index of Equipment

Clip, paste on 3 x 5-in. cards and file as desired

Crankshaft Turning Machine, Multiple-Tool
Crankshaft Co. of America, Edison Bldg., Chicago, Ill.
"American Machinist," Aug. 28, 1919.

Special machine for turning large crankshafts. Claimed to have reduced turning time from 30 days to 2 days. Length of main bed, 33 ft. 10 in.; width, 50 in.; maximum distance between faceplates, 18 ft. 10 in.; diameter of faceplates, 34½ in.; diameter of faceplate gear, 36 in. p.d.; from floor to center of spindle, 46 in.; power equipments, two 20-hp. Triumph motors; total weight, approximately 95 tons.



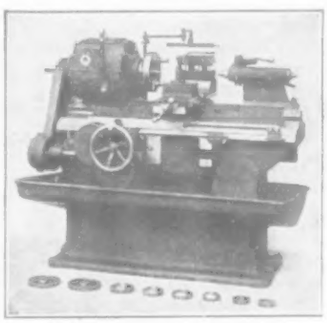
Lathe, Sliding-Head
J. J. McCabe Lathe and Machinery Corp.,
149 Broadway, New York City.
"American Machinist," Sept. 11, 1919.

Re-design of Needham lathe with geared sliding head and tail stocks and rear V lower than front V.

Maximum swing, 40 in.; swing over carriage, 16½ in.; length of bed, 12 ft. 4 in.; maximum distance between centers, 7 ft. 2 in.; tailstock spindle travel, 14 in.; highest gear ratio, 625 to 1; speed changes in geared head, 12; number of feed changes, 42; weight, 1200 lb.

Lathe, Multi-Cut Semi-Automatic
R. K. Le Blond Machine Tool Co., Cincinnati, Ohio.
"American Machinist," Sept. 18, 1919.

Adaptable to turning and facing work simultaneously. Made in two sizes; No. 6 with 6-in. swing, 10-in. centers; No. 9 with 9-in. swing, 16-in. centers. No. 6 has three styles of headstock, and No. 9 has four styles, A, B, C, or D. Taper attachments and compound rest are included, also lever-operated tailstock, spindles extended for air chucks, special expanding mandrels, etc. Eleven collets are furnished for No. 6, and 13 collets for No. 9.

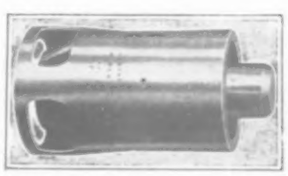


Lathe, Multi-Cut Semi-Automatic, Style C.
R. K. Le Blond Machine Tool Co., Cincinnati, Ohio
"American Machinist," Sept. 18, 1919.

No. 6 machine with style C headstock is a fixed-speed set-up head for quantity duplicate production. Speed adjusted to suit conditions by change gears, regularly furnished. Four-to-one back gears, and right-angle drive also included. Driving clutch and brake provided. Gears, brake, etc., have flooded lubrication. Style C is recommended for work on cast-iron or steel parts requiring heavy reductions and no speed changes.

Stay-Bolt Heading Attachment
Liberty Tool Co., Munsey Building, Baltimore, Md.
"American Machinist," Sept. 18, 1919.

Used for riveting stay-bolts, stay rods, or countersunk rivets on all steam, oil or water-tight work. This attachment, which fits on a standard air gun, is used for driving these parts for the service mentioned. The tool may be applied to any make of riveting hammer without making any change in the hammer.

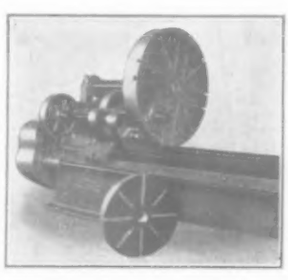


Sandblast Machine
Pangborn Corporation, Hagerstown, Md.
"American Machinist," Sept. 18, 1919.

Consists of a rotating table half exposed, and half in a dust-tight housing in which the blasting action takes place. The table top is 42-in. diameter and the entire device requires a floor space of 4 ft. 8 in. by 4 ft. 3 in. Sandblast action is of the suction type. The blast projector takes air nozzles interchangeably from ¼- to ⅝-in. diameter, and at 80-lb. pressure the air consumption, with the smaller size nozzle, is as low as 21 cu.ft. free air per minute, while the entire power for driving the table is but 1½ hp. The machine weighs 1750 lb.

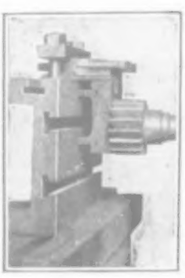
Lathe, 2-in-1 Double-Spindle
J. J. McCabe Lathe and Machinery Corp., 140 Broadway, New York City.
"American Machinist," Sept. 18, 1919

Quick-change feature; the large faceplate is never removed; the small faceplate only is changed. To make the change it is necessary to remove the internal gear driving pinion from the lower spindle and screw on in its place a steel extension spindle and the chuck or faceplate. A bronze bushing is bolted to the large faceplate as shown and forms a bearing for the spindle extension. A dowel bracket is provided for locating and locking the large faceplate and a wrench for removing the spindle extension.

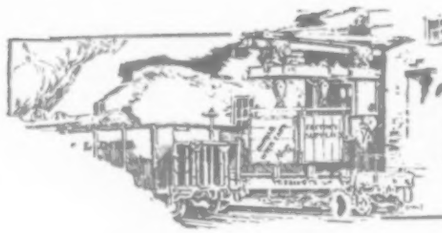


Angle Plates, 90 Degree
The Nelson Tool and Machine Co., Newark, N. J.
"American Machinist," Sept. 18, 1919.

The 90-deg. angle plate shown is made in four sizes, varying from 3 x 3½ in. up to 14 x 18 in. It is strongly ribbed and provided with a second face parallel to the base. This second face is slotted, as is the 90-deg. face of the plate. The heights of plates of the same size are kept within 1/1000 of an inch limit, as is the spacing of the T-slots. Thus they may be used in pairs for a variety of purposes where parallelism is required.



Patented Aug. 20, 1918



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co., as per Department of Commerce Committee Schedule.

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$36.60	$32.60
Northern Basic	34.00	31.05
Southern Ohio No. 2	36.55	31.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	39.40	35.65
Southern No. 2 (Silicon 2.25 to 2.75)	41.40	36.50
BIRMINGHAM		
No. 2 Foundry	33.00	30.00
PHILADELPHIA		
Eastern Pennsylvania No. 2	38.10*	33.00*
Virginia No. 2	39.10*	34.40*
Basic	34.60†	29.00†
Grey Forge	34.60*	29.40*
CHICAGO		
No. 2 Foundry local	36.25	31.40
No. 2 Foundry, Southern	38.00	34.10
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	.....	32.40
Basic	34.40	28.40
Bessemer	35.40	29.35

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.47	$3.47	$4.27	$3.37	$4.17	$3.47	$4.27
Soft steel bars	3.52	3.52	4.17	3.27	4.17	3.52	4.17
Soft steel bar shapes	3.52	3.52	4.17	3.27	4.17	3.52	4.17
Soft steel bands	4.22	4.22	4.77	.....	.....	.....	.....
Plates, ¼ to 1 in. thick	3.67	3.67	4.52	3.57	4.42	3.67	4.25

Note—For less than carload lots, add 4¼c. per 100 lb.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, N. Y.	$3.10	$3.50
Warehouse, New York	3.52	4.75
Warehouse, Cleveland	3.42	4.67
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Mill, Carloads, Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 28 black	$4.35	$6.00	$6.52	$5.77	$6.00
No. 26 black	4.25	5.90	6.42	5.67	5.90
Nos. 22-24 black	4.20	5.85	6.37	5.62	5.85
Nos. 18-20 black	4.15	5.80	6.32	5.57	5.80
No. 16 blue annealed	3.75	5.02	5.72	5.17	5.02
No. 14 blue annealed	3.65	4.92	5.62	5.07	4.92
No. 10 blue annealed	3.55	4.82	5.52	4.97	4.82
No. 28 galvanized	5.70	7.25	7.77	7.12	7.25
No. 26 galvanized	5.40	6.95	7.47	6.82	6.95
No. 24 galvanized	5.25	6.80	7.32	6.57	6.52

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.00	$4.90	$4.75
Flats, squares and hexagons, per 100 lb. base	5.50	5.40	.....

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$15.50–19.00
Cleveland	20.00	20.00
Chicago	16.50	19.00

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1, 11/16, 5/8, 9/16, 1/2, 7/16, 3/8, No. 8, 5/32 and No. 10	21.00 to 30.00	5/8 by 12 in. long	14.00
		1/2 by 19 in. long	12.00
1/4		3/8 by 19 in. long	10.00
No. 12		1/4 by 21 in. long	10.00
3/16, No. 14 and 1/8		**Special Welding Wire, Coated**	
No. 18		1/4	33.00
No. 20		5/16	30.00
Domestic 20c. for 1/16, 15c. for 1/8 to 3/16		3/8	38.00

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	8.00
Spring steel (light)	8.00	10.00	10.00
Coppered bessemer rods	8.00	8.00	6.75
Hoop steel	4.47	4.75	4.07
Cold-rolled strip steel	8.40	8.25	7.50
Floor plates	5.67	6.00	5.92

Note—For less than carload lots, add 4½c. per 100 lb.

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Mar. 21, 1919.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
1/8, 1/4 and 3/8	50½%	24%	1/8 to 1¼	30%	23½%
1/2	54½%	40%			
3/4 to 3	57½%	44%			

LAP WELD

2	50½%	35%	2	32½%	18½%
2½ to 6	53½%	41%	2½ to 6	34½%	21½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	46½%	29%	1/8 to 1/4	39½%	24½%
1/2	51½%	39%			
3/4 to 1¼	55½%	43%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	48½%	37%	2	33½%	20½%
2½ to 4	51½%	40%	2½ to 4		23½%
4½ to 6	50½%	39%	4½ to 6	34½%	22½%

Stock discounts in cities named are as follows:

	Black	Galv.	Black	Galv.	Black	Chicago Galv.
1/8 to 3 in. steel butt welded	47%	31%	43½%	34½%	57½%	44%
2½ to 6 in. steel lap welded	42%	27%	45½%	39½%	53½%	41%

Malleable fittings, Class B and C, banded, from New York stock sell at plus 12½% less 5%. Cast iron, standard sizes, 10–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	19.00	20.00	26.00
Tin in 5-ton lots	54.25-50	53.87½	72.00
Lead	6.90	6.80	7.05
Spelter	8.95	8.30	8.60
ST. LOUIS			
Lead	6.35	6.55	6.75
Spelter	8.10	7.95	8.25

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	28.50	33.50	38.00	29.50–31.00	34.00	35.00	38.00
Copper wire (carload lots)	28.00	29.00	35.00	28.50	36.00	26.00	38.00
Brass sheets	25.50	32.00	39.75	28.00	32.00	26.00	38.00
Brass pipe	30.50	36.00	46.00	34.00	42.00	34.00	44.00
Solder (half and half) (case lots)	35.00	45.00	55.00	35.50	50.50	33.00	65.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	22.75	37.75
New York	24.00	34.25
Cleveland	28.00	38.50
Chicago	25.00	29.50

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 11.00

	—In Casks—		— Broken Lots —	
	Current	One Year Ago	Current	One Year Ago
Cleveland	11.50	18.75	12.00	18.40
New York	11.50	17.00	12.50	17.50
Chicago	15.00	22.00	15.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	9.75-10	9.50-10.50
Chicago	9.50	10.00
Cleveland	11.75	11.75

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York —		—Cleveland—		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy and crucible	17.50	20.00	17.50	19.00	16.50
Copper, heavy and wire	15.50	19.00	17.50	19.00	16.25
Copper, light and bottoms	13.50	17.00	15.00	15.00	15.25
Lead, heavy	6.25	6.00	5.50	6.00	6.00
Lead, tea	5.00	4.75	4.00	4.00	5.00
Brass, heavy	9.00	11.00	13.00	14.00	16.00
Brass, light	8.00	9.00	9.50	13.00	9.50
No. 1 yellow brass turnings	9.50	11.00	10.50	10.00	10.00
Zinc	5.00	5.25	5.50	5.00	6.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00c.	32.00c.@3.00c.	33½c.

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	34.00	32.00
Chicago	28.00	38.00
Cleveland	31.00	36.50

BABBITT METAL—Warehouse price per pound:

	—New York—		—Cleveland—		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	90.00	70.00	80.00	60.00	95.00
Commercial	55.00	45.00	16.50	21.50	13.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York —		— Cleveland —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	List	.80	$1.00	$1.25	$1.45	.98
Hot pressed hexagon	List	.80	1.00	1.05	1.45	.78
Cold punched hexagon	List	2.50	1.00	.75	1.05	1.00
Cold punched square	List	2.50	1.00	.75	1.05	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	70-5%	50-10%
Chicago	50%	50%
Cleveland	60-10%	50-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	50%	35-5%
Larger and longer up to 1½ in. by 30 in.	20%	40%	25-5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $1.25 Cleveland..... $3.75 Chicago..... $3.00

For cast-iron washers the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $3.75 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	25%	40-5%	30%
Larger and longer up to 1 in. by 30 in.	15%	37½%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse.:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	30%	List plus 10%	30%	List plus 10%
Chicago	20%	List price	20%	List plus 20%
New York	30%	15% from list	10%	List plus 20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅜ and smaller	50%	55% off	50%
Tinned	50%	55% off	50%

Boiler, ½, ¾, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York...$5.00 Cleveland...$4.00 Chicago....$4.87 Pittsburgh...$4.72

Structural, same sizes:

New York...$5.10 Cleveland...$4.10 Chicago....$4.97 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	32.00	36.00	35.00
Brass	30.50	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb., advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK			
	Current	One Year Ago	Cleveland	Chicago
White	13.00	1.00-13.00	14.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50-12.00	11.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$1.75	$1.75
Philadelphia	2.00	1.75	1.75
Cleveland	2.50	2.50	2.40
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.65	$3.65
Cleveland	3.875	3.875	4.25
Chicago	4.12½	4.125	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Dec. 9	Dec. 2	Nov. 9
Prompt furnace	$6.00	$6.50	$6.00
Prompt foundry	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	— New York —		— Chicago —	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.90	$1.59	$2.09	$1.90
5-gal. cans	2.07	1.84	2.34	2.00

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current One Year Ago	
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	14.00	16.10	14.00	14.50	14.00	14.00
25 and 50-lb. kegs	14.25	15.75	14.25	14.75	14.25	14.25
12½-lb. keg	14.50	16.00	14.50	15.00	14.50	14.50
5-lb. cans	16.00	17.50	.....	.....	16.00	16.00
1-lb. cans	17.00	18.50	.....	.....	17.00	17.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—The Bassick Co., 38 Austin St., manufacturer of casters, has awarded the contract for the construction of a 6 story, 67 x 178 ft. factory, on Myrtle Ave. Estimated cost, $200,000.

Conn., Bridgeport—The Locomobile Co. of America, 2 Main St., has awarded the contract for the construction of a 2 story, 50 x 80 ft. factory for the manufacture of automobiles. Estimated cost $30,000.

Conn., Hartford—The Johnson-Webster Co., 159 Washington St., has awarded the contract for the construction of a 3 story, 50 x 150 ft. garage on Washington and Park St. Estimated cost, $65,000.

Conn., New Haven—The Smedley Co., 266 State St., has awarded the contract for the construction of a 1 story garage on Brewery St. Estimated cost, $25,000.

Conn., Thomaston—The Waterbury Jewel Co., Inc., 31 Canal St., has awarded the contract for the construction of a 3 story, 95 x 100 ft. factory, on River St. for the manufacture of watches. Estimated cost, $55,000.

Conn., Waterbury—A. C. Campbell & Co., 42 State St., has awarded the contract for the construction of a 4 story, 35 x 100 ft. factory and a 2 story, 35 x 140 ft. factory, with a 50 x 60 ft. ell. Estimated cost, $60,000.

Conn., Waterbury—The Lux Clock Manufacturing Co., 97 Sperry St., has awarded the contract for the construction of a 2 story, 30 x 54 ft. factory, for the manufacture of clocks. Estimated cost, $12,000.

Conn., Waterbury—The Noera Manufacturing Co., Griggs St., will build a 1 story, 35 x 160 ft. factory, for the manufacture of hardware. Estimated cost, $25,000.

Mass., Cambridge—The G. H. Dyer Co., 15 Brookline St., welders, has awarded the contract for the construction of a 1 and 2 story, 30 x 40 ft. and 55 x 100 ft. boiler house and factory. Estimated cost, $30,000.

Mass., Cambridge—The Eco Manufacturing Co., 941 Exchange St., Boston, is having plans prepared by Densmore & Le Clear, Archts., 88 Broad St., Boston, for the construction of a 1 story, 50 x 110 ft. factory, on Charles River Parkway, for the manufacture of machinery. Estimated cost, $40,000.

Mass., Clinton—The Lancater Mills have awarded the contract for the construction of an 8 story, 102 x 120 ft. factory, for the manufacture of textiles. Estimated cost, $200,000.

Mass., Dorchester (Boston P. O.)—The American Radiator Co., 820 South Michigan Ave., Chicago, has awarded the contract for the construction of an assembly plant and warehouse on Mt. Vernon St., here. Estimated cost, $1,500,000.

Mass., Everett—W. W. Partridge, c/o The National Garage, School St. plans to build a 1 story, 60 x 120 ft. garage on Boulevard and 2nd St. Estimated cost, $25,000. W. T. Littlefield, 9 Hamilton Pl., Boston, Arch.

Mass., Holyoke—The Stevens Duryea Co., Main St., Chicopee Falls, manufacturer of automobiles, has awarded the contract for the construction of a 1-story, 300 x 320 ft. factory, on Willimansett St., here.

Mass., Lowell—The Saco-Lowell Co., 777 Franklin St., Boston, is having plans prepared by Lockwood, Greene Co., Arch., 60 Federal St., Boston, for the erection of a 2 story, machine shop and foundry. Estimated cost, $250,000.

Mass., Lynn—J. F. Hunt, 28 Mulberry St., will soon award the contract for the construction of a 1 story, 40 x 150 ft. garage on Pleasant St. Estimated cost, $25,000. Burk & Bottomley, 34 School St., Boston, Arch.

Mass., Plymouth—The Plymouth Buick Co., plans to build a 1 story, 80 x 175 ft. garage and service station on Sandwich St. Estimated cost, $65,000.

Mass., Westfield—The Vitrified Wheel Co., Emery St., will soon award the contract for the construction of a 2 story, 42 x 85 ft. factory. Estimated cost, $25,000.

Mass., Worcester—J. V. Critchley, 214 Salisbury St., plans to build a 1 story machine shop on Southbridge St. S. H. Pitcher Co., 44 Front St., Arch.

Mass., Worcester—The Livingston Motor Co., 109 Grafton St., has awarded the contract for the construction of a 3 story, 80 x 250 ft. sales and service station and an assembling plant, on Shrewsbury St. Estimated cost, $150,000.

Mass., Worcester—The Morgan Construction Co., 15 Belmont St., has awarded the contract for the construction of a 2 story, 45 x 97 ft. factory on Lincoln St., for the manufacture of rolling mill machinery. Estimated cost, $30,000.

Mass., Worcester — Walden-Worcester Inc., 72 Commercial St., has awarded the contract for the construction of a 1 story, 132 x 173 ft. factory, on Shrewsbury St., for the manufacture of wrenches. Estimated cost, $65,000.

R. I., Auburn (Providence P. O.)—The Universal Winding Co., has awarded the contract for the construction of a 2 story, 102 x 103 ft. foundry. Estimated cost, $100,000.

R. I., East Providence—The Sayles Finishing Plants, 891 3rd St., Pawtucket, has awarded the contract for the construction of a 1 story, 44 x 100 ft. and 42 x 66 ft. factory, for the manufacture of textiles. Estimated cost, $25,000.

R. I., Pawtucket—The W. H. Haskell Manufacturing Co., Main St., will soon award the contract for the construction of a 2 story, 80 x 160 ft. machine shop. Estimated cost, $100,000. W. B. Lewis, Grosvener Bldg., Providence, Arch.

R. I., Pawtucket—The Sawyer Belt Hook Co., 16 Warren Ave., is building an addition to its factory.

MIDDLE ATLANTIC STATES

Md., Baltimore—T. H. O'Connor, 445 Guilford Ave., plans to build a 4 story, 18 x 100 ft. warehouse, on a site adjoining present plant. Estimated cost, $50,000. J. H. Smallwood, 3915 Kate Ave., Arch.

N. J., Newark—The McAllister, Carlton, Stultz Corporation, 1003 Broad St., will soon award the contract for the construction of a 2 story, 165 x 375 ft. garage and service station, at 997-9 Broad St. Estimated cost, $200,000.

N. J., Newark—Roth & Co., 45 Market St., will soon award the contract for the construction of a 2 story garage, on Plane and Eagle St. Estimated cost, $100,000. W. Lehman, 738 Broad St., Arch.

N. Y., Great Neck—R. Levanding, 120 Broadway, New York City, will build a garage here. Estimated cost, $25,000. A. Hopkins, 101 Park Ave., New York City, Arch.

N. Y., New York (Borough of Bronx)—J. Basheim, c/o Moore & Lanseidel, Arch., 3rd Ave. and 148th St., plans to build a 1 story, 100 x 175 ft. garage, on Southern Blvd. and Longworth Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Bronx)—Jenphil Realty Corporation, 1060 Findlay Ave., will build a 1 story, 100 x 150 ft. garage on Webster Ave. and 166th St. Estimated cost, $25,000.

N. Y., New York (Borough of Bronx)—G. M. S. Schulz, 1410 Cortlandt Park, East, will build a 1 story, 77 x 172 ft. garage on Boston Rd. and 176th St. Estimated cost, $20,000.

N. Y., New York (Borough of Brooklyn)—The American Machine Foundry Co., 55th and 56th St., has awarded the contract for the construction of a 6 story, 127 x 190 ft. addition to its factory.

N. Y., New York (Borough of Brooklyn)—The Couch-Haas Motors Corporation, 1537 Bedford Ave., has awarded the contract for the construction of a 2 story, 80 x 185 ft. factory, on Henry, Ely and Willow Sts.

N. Y., New York (Borough of Brooklyn)—S. Elsenberg, 1499 Lincoln Pl., will build a 1 story, 115 x 160 ft. garage at 342-352 Coney Island Ave. Estimated cost, $50,000.

N. Y., New York (Borough of Brooklyn)—The Franconia Realty Co., 52 Norfolk St., New York City will build a 1 story, 85 x 95 ft. garage, on Franklin Ave. and Crown St., here. Estimated cost, $15,000.

N. Y., New York (Borough of Brooklyn)—H. Frank, c/o Ebling, Magnusen & Kleinert, Engr., 52 Vanderbilt Ave., Manhattan, will build a 1 story, 200 x 300 ft. garage on Eastern Parkway. Estimated cost $80,000.

N. Y., New York (Borough of Brooklyn)—H. B. and H. L. Realty Co., 735 Greene Ave., will build a 1 story, 95 x 120 ft. garage on 38th St. and 13th Ave. Estimated cost, $40,000.

N. Y., New York (Borough of Brooklyn)—J. L. Link, 833 St. John's Pl., will build a 1 story, 75 x 100 ft. garage, on Park and Throop Aves. Estimated cost, $75,000.

N. Y., New York (Borough of Brooklyn)—The Norman Holding Co., 690 Broadway, will build a 1 story, 45 x 100 ft. garage, on Hancock St. and Wykoff Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Brooklyn)—The Parkway Riding Academy, East 8th St., will soon award the contract for the construction of a 1 and 2 story, 25 x 57 ft. and 60 x 85 ft. garage. Estimated cost, $40,000. M. Whinston, 63 Park Row, New York City, Arch.

N. Y., New York (Borough of Manhattan)—L. and N. Construction Co., c/o D. S. Lang, Arch., 110 West 34th St., will build a 1 story, 50 x 92 ft. garage. Estimated cost, $15,000.

N. Y., New York (Borough of Queens)—The Goodwin Motor Sales Corporation, North Park Ave., Rockville Centre, will soon award the contract for the construction of a 1 story, 75 x 170 ft. garage. Estimated cost, $65,000. E. Holmgren, 373 Fulton St., Brooklyn, Archt.

N. Y., New York (Borough of Queens)—The Queens Electric Light and Power Co., 347 Central Ave., Far Rockaway, has awarded the contract for the construction of a 1 story, 40 x 200 ft. garage, on Reade and Jane Sts., Long Island City. Estimated cost, $150,000.

N. Y., Syracuse—The Greenway Brewing Co. has awarded the contract for the construction of a 3, 5 and 7 story, 80 x 500 ft. garage on West Water St. Estimated cost, $250,000.

N. Y., Syracuse—The Smith Wheel Co., 100 North Geddes St., plans to build a factory for the manufacture of metal wheels. Estimated cost, $35,000. Gagin & Gagin, University Bldg., Arch.

N. Y., Watertown—The Hungerford Holbrook Co., 735 Washington St., plans to build a 3 story addition to its present plant. Estimated cost, between $75,000 and $100,000. C. E. Holbrooke, Treas.

..Penn., Philadelphia—Abbott, Alderney, Davies, Inc., Chestnut and 31st St., has awarded the contract for the construction of a 1 story, 104 x 121 ft. garage, on 3rd and Lombard Sts. Estimated cost, $20,000.

Penn., Philadelphia — The Gomery-Schwartz Co., 128 North Broad St., will soon receive bids for the construction of a 6 story, 210 x 440 ft. service and sales station, at 24th and Market St. Estimated cost, $700,000. C. E. Oelschlager, 1615 Walnut St., Arch.

Penn. Philadelphia—J. C. Gracey, 1230 North 26th St., has awarded the contract for the construction of a 1 story, 54 x 130 ft. garage, at 1228-32 North St. Estimated cost, $14,000.

Penn., Philadelphia—J. Woldow, c/o J. E. Feldstein, Arch., Penfield Bldg., will soon award the contract for the construction of a 2 story, 50 x 120 ft. garage at 707 Tasker St. Estimated cost, $20,000.

Penn., Wilkes-Barre—The Hazard Manufacturing Co., 81 East Ross St., has awarded the contract for the construction of a 1 story, 28 x 76 ft. garage on South Penn Ave. Estimated Cost, $12,000.

SOUTHERN STATES

S. C., Charleston—The Cosgrove Automobile Co., has had plans prepared by J. D. Newcomer, Arch., 32 Broad St., for the construction of a 2 story, 94 x 94 ft. garage and salestation, on Ann and Metting St. Estimated cost, $50,000.

S. C., Columbia—N. Jordan, Palmetto Bldg., has awarded the contract for the construction of a 2 story garage and shop. Estimated cost, $30,000.

MIDDLE WEST

Ill., Chicago—A. S. Alschuler, Arch., 28 East Jackson St., will soon award the contract for the construction of a 1 story, 135 x 356 ft. factory and foundry on Lake and Kildare St., for the Sloan Valve Co., 617 West Jackson Blvd. Estimated cost, $75,000.

Ill., Chicago—The Chicago Electric Co., 2817 South Halsted St., has awarded the contract for the construction of a 2 story, 100 x 135 ft. factory on Halsted and 28th St. Estimated cost, $75,000.

Ill., Chicago—The Doehler Die Casting Co., 4429 North Campbell Ave., has awarded the contract for the construction of a 1 story, 150 x 300 ft. factory, on 97th and Cottage Grove St. Estimated cost, $150,000.

Ill., Chicago—The Premier Lithographing Co., c/o L. C. Bouchard, Arch., 64 West Randolph St., will soon award the contract for the construction of a 4 story, 60 x 70 ft. printing plant, at 1855 North Halsted St. Estimated cost, $100,000.

Mich., Bay City—The Union Motor Truck Co., 1112 North Water St., will build a 1 story, 100 x 500 ft. and a 2 story, 100 x 500 ft. factory, with 100 x 200 ft. foundry and power house. Estimated cost, $2,000,000.

Mich., Detroit—I. Applebaum, 2023 Dime Bank Bldg., will soon award the contract for the construction of a 3 story, 76 x 180 ft. factory on Russell St. Estimated cost, $100,000. A. A. Harley, Kresge Bldg., Arch.

Mich., Detroit—The Bemb-Robinson Co., 286 East Jefferson St., will soon award the contract for the construction of a 2 story, 30 x 120 ft. service station on Larned St. Estimated cost, $30,000. Baxter, O'Dell & Halpin, 1024 Hammond Bldg., Arch.

Mich., Detroit—The Central Axle Co., c/o The General Motors Corporation, 435 Woodward Ave., has awarded the contract for the construction of a 1 story, 240 x 1080 ft. factory, on Holbrook Ave.

Mich., Detroit—A. J. Detlaff, 121 Lafayette St., E., plans to build a 1 and 2 story foundry and machine shop on Grand River Ave. and Terminal Ry.

Mich., Detroit—The Federal Tool Co., Appie St., has awarded the contract for the construction of a 2 story, 22 x 57 ft. and 60 x 115 ft. machine shop. Estimated cost, $32,000.

Mich., Detroit—The Fisher Body Co., Oakland and Piquette Ave., has awarded the contract for the construction of a 1 story, 123 x 678 ft. train shed and press plant, on West End and Fort St.

Mich., Detroit—The Hudson Motor Car Co., 2901 East Jefferson Ave., will soon award the contract for the construction of a 4 story, 82 x 584 ft. assembly plant. Esselstyn, Murphy & Hanford, Marquette Bldg., Arch.

Mich., Detroit—The Lincoln Motor Co., Tireman Ave., has awarded the contract for the construction of a 2 story factory, garage and testing room. Estimated cost, $175,000.

Mich., Detroit—B. Robinson Co., 286 East Jefferson Ave., is having plans prepared by Baxter, O'Dell & Halpin, Arch., 1024 Hammond Bldg., for the construction of a 2 story, service station on Larned St. Estimated cost, $70,000.

Mich., Detroit—C. Singer, 271 East Kirby Ave., is having plans prepared by I. M. Lewis, Arch., Congress Bldg., for the construction of a 2 story, 75 x 120 ft. garage, on Oakland and Woodland Ave. Estimated cost, $60,000.

Mich., Detroit—The Studebaker Corporation, Brush and Piquette Ave., will soon award the contract for the construction of a 4 story, 200 x 250 ft. addition to its factory. Estimated cost, $300,000. A. Kahn, Marquette Bldg., Arch.

Mich., Detroit—The J. C. Wilson Co., 15th and Warren Ave., has awarded the contract for the construction of a 1 story, 60 x 150 ft. assembly plant.

Mich., Grand Rapids—The Watson-Higgins Milling Co., 506 2nd St., has awarded the contract for the construction of a 2 story, 100 x 150 ft. garage, on Division Ave., N. Estimated cost, $22,000.

Mich., Jackson—R. Gage, c/o The Hupp Garage, Park Ave., will soon award the contract for the construction of a 2 story, 33 x 120 ft. garage. Estimated cost, $10,000. H. R. Graf, 502 Carter Bldg., Arch.

Mich., Jackson—The Hup Motor car Co., Park Ave., has awarded the contract for the construction of a 1 story, 170 x 280 ft. factory.

Mich., Jackson—The Jackson Metal Products Co., 601 Liberty St., has awarded the contract for the construction of a 1 story, 113 x 130 ft. factory. Estimated cost, $50,000.

Mich., Jackson—The Michigan Buick Sales Co., 104 East Washington St., will soon award the contract for the construction of a 1 story, 50 x 132 ft. garage. Estimated cost, $20,000. H. R. Graf, 502 Carter Bros. Bldg., Arch.

Mich., Jackson—The Sparks Withington Co., North St., manufacturer of automobile parts, is having plans prepared by Withington. Roberts & Wright Co., Arch., Swetland Bldg., Cleveland, Ohio, for the construction of a 4 story, 100 x 300 ft. factory, office and warehouse. Estimated cost, $200,000.

Mich., Kalamazoo—Fuller & Sons Manufacturing Co., Pritcher St., manufacturer of automobile parts, will soon award the contract for the construction of a 4 story, 65 x 75 ft. factory, on Pitcher and Prouty St. Estimated cost, $75,000. Smith, Hinchman & Grylls, 710 Washington Arcade, Arch.

Mich., Lansing—The Fireproof Storage and Transfer Co., 514 Oakland Bldg., will soon award the contract for the construction of a 1 story, 56 x 104 ft. garage. Estimated cost, $20,000. J. N. Churchill, 514 Oakland Bldg., Arch.

Ohio, Cincinnati—The G. C. Miller Carriage Co., 713 Main St., will soon award the contract for the construction of a 2 story, 50 x 86 ft. garage, on Gilbert Ave. Estimated cost, $50,00. Dittoe, Fahnestock & Ferber, 17 West 7th St., Arch.

Ohio, Cleveland—The Aetna Steel Castings Co., 2284 Scranton Rd., has awarded the contract for the construction of a 1 story, 20 x 35 ft. addition to its foundry. Estimated cost, $5000. A. W. Fanton, Pres.

Ohio, Cleveland—The Briggs Manufacturing Co., East 131st St. and Taft Ave., will soon award the contract for the construction of a 1 story, 72 x 160 ft. factory for the manufacture of automobile bodies. Estimated cost, $75,000. W. S. Ferguson, 1900 Euclid Bldg., Arch.

Ohio, Cleveland—The International Motor Co., 1325 West Front St., Plainfield, N. J., has awarded the contract for the construction of a 1 story, 100 x 200 ft. garage and salesroom, on East 70th St. and Carnegie Ave., here. Estimated cost, $75,000.

Ohio, Cleveland—J. Rutkowski, 7001 Polonia Ave., will soon award the contract for the construction of a 1 story, 81 x 142 ft. factory, at 6600 Park Ave., for the manufacture of iron fences, etc. Estimated cost, $40,000.

Ohio, Cleveland—W. H. Smith, 66 Taylor Rd., East Cleveland, has awarded the contract for the construction of a 1 story, 140 x 140 ft. machine shop and foundry. Estimated cost, $50,000.

Ohio, Cleveland—The Titan Screw Products Co., 1175 East 152nd St., plans to build a factory and machine shop. Estimated cost, $200,000. W. J. Hayes, Pres.

Ohio, Dayton—P. R. Gruner, 109 South St. Clair St., plans to build a 3 story, 24 x 125 ft. printing plant. Estimated cost, $75,000.

Ohio, Dayton—The Maxwell Motor Co., Leo St., has awarded the contract for the construction of a 1 story, 45 x 60 ft. boiler house and a 100 x 120 ft. factory. Total estimated cost, $35,000.

Ohio, Dayton—The Standard Register Co., Albany St., manufacturer of registers, plans to build a 1 and 2 story, 80 x 100 ft. factory. Estimated cost, $35,000.

Wis., Milwaukee—The Gemco Manufacturing Co., 742 South Pierce St., is having plans prepared by M. Ferneks, Arch., Railroad Exchange Bldg., for the erection of a 2 story, 50 x 150 ft. factory for the manufacture of garage equipment. Estimated cost, $50,000.

Wis., Milwaukee—The Nordberg Manufacturing Co., Chicago and Oklahoma St., has awarded the contract for the construction of a 1 story, 100 x 120 ft. addition to its machine shop. Estimated cost, $60,000.

Wis., Milwaukee—The A. C. Smith Corporation, 27th and Keefe Ave., has awarded the contract for the construction of a 1 story, 160 x 740 ft. machine shop on Hopkins St. Estimated cost, $300,000.

WEST OF THE MISSISSIPPI

Col., Denver—T. Roberts, 1235 Broadway, has awarded the contract for the construction of a 1 story, 100 x 125 ft. garage on 11th Ave. and Bannock St. Estimated cost, $75,000.

Minn., Minneapolis—The Red River Lumber Co., 807 Hennepin Ave., will soon award the contract for the construction of a 2 story, 100 x 135 ft. garage on Franklin and Lyndale Ave. Estimated cost, $50,000. C. L. Kinport, Andrus Bldg., Arch.

Mo., Joplin—The Norton Taxicab Co., 220 West 6th St., will soon award the contract for the construction of a 5 story, 100 x 156 ft. garage and salesroom. Estimated cost, $100,000.

Tex., Ft. Worth—S. C. Cunningham, 209½ West 8th St., will build a 2 story, 95 x 100 ft. garage and automobile sales station on 6th and North Main St. Estimated cost, $35,000.

CANADA

Ont., Hamilton—The Spectator Printing Co., James St., has awarded the contract for the construction of a 3 story, 60 x 120 ft. factory on James St., S. Estimated cost, $100,000.

Que., Montreal—The Berliner Gramophone Co., St. Antoine St., has awarded the contract for the construction of a 1 story, 30 x 90 ft. factory. Estimated cost, $16,960.

General Manufacturing

NEW ENGLAND STATES

Conn., Danielson—The Goodyear Cotton Mills, Inc., plans to build a 3 story, 146 x 366 ft. factory.

Conn., Danielson—The River Weaving Co., Inc., Water St., will build a 2 story, 30 x 80 ft. addition to its mill. Estimated cost, $12,000.

Conn., Stamford—The Stollwerck Chocolate Co., Greenwich Ave., will build a 1 story, 40 x 285 ft. addition to its plant on Sunnyside Ave. Estimated cost, $25,000.

Mass., Fall River—The Sanford Spinning Co., 206 Globe Mills Ave., has awarded the contract for the construction of a 3 story, 120 x 350 ft. addition to its tire fabric mill. Estimated cost, $400,000.

Mass., Somerville (Boston P. O.)—The Prospect Hill Bottling Co., 153 Cross St., will soon award the contract for the construction of a 2 story, 60 x 100 ft. and 60 x 120 f. bottling plant. Estimated cost, $60,000. J. W. Hyson, 62 Beach Ave., Melrose, Arch.

N. H., Troy—The Troy Blanket Mills have awarded the contract for the construction of a 4 story, 68 x 289 ft. factory and a 2 story, 64 x 224 ft. picker house. Estimated cost, $350,000.

R. I., East Providence (Providence P. O.)—The Sayles Finishing Plants, Phillipsdale, dyers and bleachers, have awarded the contract for the construction of a 1 story, 40 x 65 ft. and 45 x 100 ft. factory. Estimated cost, $25,000.

R. I., East Providence (Providence P. O.)—The Tidewater Oil Co., 34 Central Wharf, Boston, Mass., has awarded the contract for the construction of a distributing station on Massosoit Ave. Estimated cost, $30,000.

R. I., Providence—The Dolbey Ice Cream Co., 485 Plainfield St., has awarded the contract for the construction of a 2 story, 35 x 60 ft. factory. Estimated cost, $25,000.

R. I., Riverpoint—The B. B. and R. Knight Corporation, 21 South Main St., Providence, will build a 3 story, 154 x 420 ft. weave shed, here. Estimated cost, $400,000.

MIDDLE ATLANTIC STATES

Md., Baltimore—Heineman Bros., Exeter St. and Eastern Ave., plan to alter and enlarge their 6 story, 70 x 100 ft. cigar factory. Estimated cost, $10,000. B. Frank, 328 North Charles St., Arch.

Md., Baltimore—The F. Steil Brewing Co., 202-212 Garrison Ave., plans to remodel brewery into slaughter house and packing plant. Estimated cost, $150,000.

N. J., Bayonne—The White Oil Corporation, 501 5th Ave., New York City, has purchased a 16-acre site along the water front, here, and plans to build a distributing station for domestic and exporting business, a canning plant, etc. Cost to exceed $250,000.

N. Y., New York (Borough of Brooklyn)—The Diana Chocolate Co., 382 Jefferson Ave., has awarded the contract for the construction of a 5 story, 84 x 200 ft. factory on Wysoff and Willoughby Ave. Estimated cost, $100,000.

N. Y., New York (Borough of Brooklyn)—The Metal Tube and Hose Co., c/o A. Ullrich, Arch., 371 Fulton St., has awarded the contract for the construction of a factory on Tellery and Raymond St. Estimated cost, $70,000.

N. Y., New York (Borough of Brooklyn)—Rigney & Co., 348 Park Ave., has awarded the contract for the construction of an 8 story, 75 x 90 ft. candy factory, on Park Ave. and Ryerson St.

N. Y., New York (Borough of Manhattan)—The National Gum and Mica Co., 2-10 West End Ave., is having plans prepared by J. M. Felson, Arch., 1133 Broadway, for a 25 x 100 ft. addition to its factory, at 12 West End Ave.

N. Y., New York (Borough of Queens) The American Hard Rubber Co., College Point, Manhattan, is having plans prepared by W. Kidde, Arch., 140 Cedar St., for the construction of a 1 story, 120 x 130 ft. addition to its factory.

N. Y., Rochester—The Eastman Kodak Co., 333 State St., plans to build a 5 story, 60 x 90 ft. factory on Caledonia Ave. Estimated cost, $80,000.

N. Y., Rochester—The E. W. Hamilton Manufacturing Co. plans to build a 2 story, 55 x 195 ft. factory, on Hollenbeck St., for the manufacture of paper boxes. Estimated cost, between $20,000 and $25,000.

N. Y., Syracuse—The Mills Oil Co., 263 Walton St., plans to build a plant, to consist of several buildings, on North Clinton St. Estimated cost, $200,000.

Penn., Coatesville—B. R. Stevens, Arch., 1737 Filbert St., will soon award the contract for the erection of a 2 story, 80 x 126 ft. factory, for Breunpinger Bros., 338 East Lincoln St., manufacurer of ice cream.

Penn., Philadelphia—The Standard Crown Co., Hope and Palmer St., manufacturers of bottles and stoppers, is having plans prepared by Mills & Van Kirk, Arch., Harrison Bldg., for the construction of a factory, on Howard and Palmer St. Estimated cost, $10,000.

SOUTHERN STATES

N. C., Durham—The Durham Hosiery Mills will soon award the contract for the construction of a 7 story, 115 x 255 ft. factory. L. E. Sirrine, Greenville, S. C., Arch.

N. C., Mt. Holly—The Globe Yarn Mill Co. plans to build a 1 story, 100 x 250 ft. mill. R. C. Biberstein, 614 Elizabeth Ave., Charlotte, Arch.

N. C., Winston-Salem—P. H. Haynes Knitting Co. has increased its capital stock from $2,000,000 to $12,000,000, and will increase the capacity of their plant.

MIDDLE WEST

Ill., Chicago—The Arabol Manufacturing Co., 100 William St., New York City, is having plans prepared by A. Smith, Arch., 1422 Parnell Ave., Chicago, for the construction of a factory, for the manufacture of pastes, glues and gums. Estimated cost, $100,000.

Ill., Chicago—The Chicago Addressing Co., 720 South Dearborn St., plans to build a 6 story, 95 x 100 ft. printing plant and office building. Estimated cost, $250,000.

Ill., Chicago—The National Beverage Co., 1926 West 18th St., is having preliminary plans prepared by R. Griesser, arch., 64 West Randolph St., for the construction of a 2 story addition to its factory. Estimated cost, $150,000.

Mich., Yale—The Yale Woolen Mills are having plans prepared by H. H. Lane, Arch., 2320 Dime Bank Bldg., Detroit, for the construction of a 3 story, 60 x 300 ft. addition to their mill. Estimated cost, $100,000.

Ill., Chicago—The Uniform Printing and Supply Co., 351 West Chicago Ave., will soon award the contract for the construction of a 2 story, 150 x 175 ft. printing plant at 1101 North La Salle St. Estimated cost, $225,000. C. S. Frost, 105 South La Salle St., Arch.

Ohio, Ashland—The Ashland Tire & Rubber Co., has awarded the contract for the construction of a 2 story, 100 x 240 ft. factory. Estimated cost, $150,000.

Ohio, Cincinnati—The American Dramalt Co., Riverside, plans to build a 53 x 55 ft. building for drying purposes. O. W. Brach, Commercial Tribune Bldg., Arch.

Ohio, Cleveland—The Sheriff Street Market House Co., East 4th St. and Bolivar Rd. is having plans prepared by G. S. Rider & Co., Arch., Century Bldg., for the construction of a 12 story, 85 x 200 ft. cold storage plant. Estimated cost, $1,000,000.

Mich., Detroit—The Yeomens Box Co., Wight St., has awarded the contract for the construction of a 1 story, 100 x 240 ft. factory.

Wis., Milwaukee—The Manufacturers Box Co., per F. L. Weyenberg Shoe Co., 130 Reservoir Ave., is having plans prepared by H. J. Esser, Camp Bldg., for the construction of a 1 story, 100 x 300 ft. factory on Bremen and Keefe St., for the manufacture of shoe boxes. Estimated cost, $100,000.

Wis., Sheboygan—The Northern Furniture Co., South Water and New Jersey St., is having plans prepared by W. C. Weeks, Arch., Ontario Ave., for the construction of a 4 story, 60 x 150 ft. factory, for the manufacture of chairs. Estimated cost, $10,000.

Wis., South Milwaukee—The Universal Aniline Dyes and Chemical Co., 1009 Wells Bldg., Milwaukee, has purchased a site, here, and plans to build a plant, to consist of a 1 story, 30 x 40 ft. laboratory, power house, dye houses, warehouse, office building and factory. Estimated cost, $200,000.

WEST OF THE MISSISSIPPI

Iowa, Burlington—W. A. Rayburn Co., Hamilton, Ill., plans to build a 1 story factory, for the manufacture of glass, on North Bottoms St. Estimated cost, $300,000.

Col., Denver—The Denver Post Printing and Publishing Co., 1544 Champa St., has awarded the contract for the construction of a 4 story, 50 x 125 ft. printing plant. Estimated cost, $150,000. Noted Sept. 18.

Kan., Sterling—The Arnold Madans Milling Co. has awarded the contract for the construction of a 7 story, 40 x 200 ft. mill. Estimated cost, $250,000.

CANADA

Que., Montreal—B. J. Coghin & Co., Ltd., 2050 Ontario St., will soon award the contract for the construction of a 2 story, 40 x 108 ft. factory for the manufacture of oils and greases. Estimated cost, $18,600.

Que., Montreal—The Canada Sugar Refining Co., 300 Montgomery St., has awarded the contract for the construction of a 3 story, 20 x 53 ft. factory. Estimated cost, $17,000.

Nova Scotia, Bedford—Moirs, Ltd., biscuit manufacturer and confectioner, is having plans prpared for the construction of a 50 x 70 and 50 x 110 ft. saw mill and box factory. Estimated cost, $35,000.

Machine Tools Wanted

The following concerns are in the market for machinery and machine tools:

Mass., Cambridge—The General Radio Co., Massachusetts Ave. and Windsor St.—drill holder with spring collars to hold straight shank drill for screw machine work, to hold drills from $\frac{1}{16}$ to $\frac{1}{4}$ in.

N. Y., Binghamton—The Remlik Paper Box Co., Inc., 8 Tompkins St.—paper box making machinery, (new).

N. Y., New York (Borough of Manhattan)—The Kennedy & Van Saum Manufacturing and Engineering Corporation, 120 Broadway—12 ft. boring mill, with adjustable housing, for 18 to 20 ft. cylinders.

Penn., Philadelphia—A. H. Campbell, 1138 Wyoming Ave.—milling machines, shapers radial drills and engine lathes, (used).

Penn., Philadelphia—J. F. Rauen, 1316 South 22nd St.—squaring shears for roofing.

Penn., Philadelphia—O. Reid, 67 Laurel St.—3 to 6 ft. radial drills, large boring mills, 10 to 16 ft., and large planers.

Ill., Chicago—The Rockwell-Barnes Co., 815 South Wabash Ave.—automatic machine, to make paper fasteners. (new).

Ind., Huntington—The Majestic Co.—a pair of Gap shears for cutting 16 ga. sheet metal, 48 in. wide, (new).

Ind., Marion—The Indiana Truck Corporation—No. 2 grinder for grinding milling cutters, up to 18 in. diameter, (new).

Mich., Bay City—The Union Motor Truck Co., 1112 North Water St.—conveyors and all machine tool equipment for the manufacture of motor trucks.

Mich., Coldwater—The Regal Gasoline Engine Co.—machines for grinding cams ready assembled on shaft, longest cam 5 ft. 8 in. (new).

Mich., Detroit—A. J. Detlaff, 121 Lafayette St., E.—complete foundry and machine shop equipment.

Mich., Detroit—The Federal Tool Co., Apple St.—machine shop equipment for general machine shop work.

Mich., Detroit—The Fisher Body Corporation, Oakland and Piquette St.—power presses and traveling cranes.

Mich., Detroit—The Hudson Motor Car Co., 2901 East Jefferson Ave.—hoists, conveyors and carrier system.

Mich., Detroit—B. Robinson Co., 286 East Jefferson Ave.—tools for auto repair department.

Mich., Detroit—The Universal Bottle Washer Co., Lorraine and Grand River Ave.—No. 3 milling machine or a plain milling machine and a 20 to 24 in. shaping machine, (new or used).

Mich., Detroit—The Yeomens Box Co., Wight St.—wood working machinery for making boxes, shooks, crates, etc.

Mich., Grand Rapids—The Watson-Higgins Milling Co., 506 2nd St.—machine shop equipment for repair work.

Mich., Jackson—The Jackson Metal Products Co., 601 Liberty St., presses and stamping machines.

Wis., Milwaukee—The Nordberg Manufacturing Co., Chicago and Oklahoma St.—traveling cranes.

Fla., Jacksonville—The Southern Iron Works, South Jax St.—a lathe with 5 ft. swing to turn locomotive drivers on axles, (new).

Ont., Adelaide—The Adelaide Oil Co.—oil piping and drilling machinery.

Ont., Toronto—Appleon & Chimpman, 68 Wellington St., E.—milling stones, corn oil machinery, such as hydraulic presses, feed dryers, copper convertors, vacuum pans, filter presses, attritition machinery and spiral conveyors.